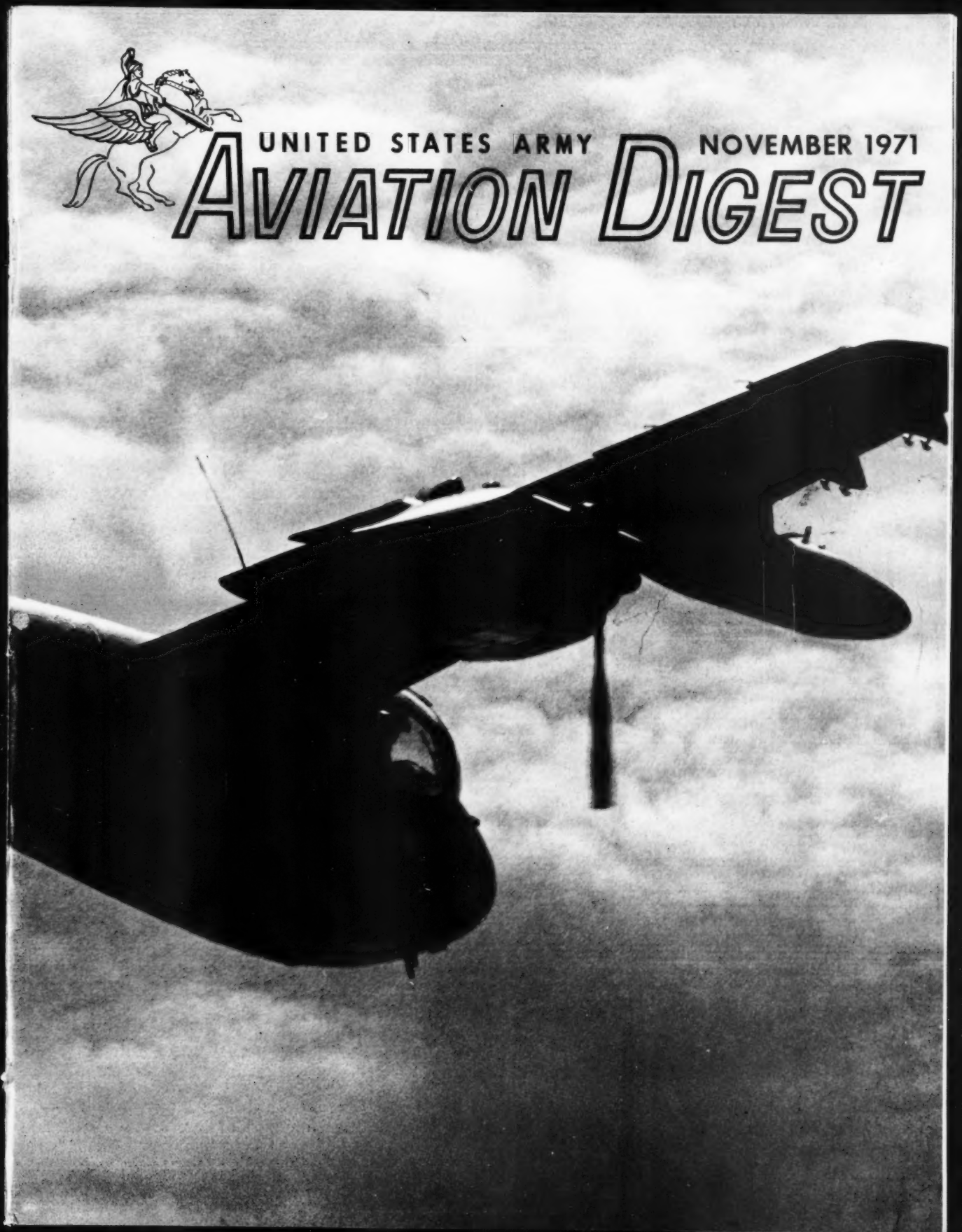
UNITED STATES ARMY
NOVEMBER 1971
AVIATION DIGEST

UNITED STATES ARMY AVIATION

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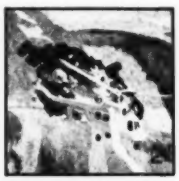

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ABOUT THE COVERS

An Army OV-1C Mohawk departs a base near Qui Nhon on a morning surveillance mission in support of ARVN forces operating in the highlands of the Republic of Vietnam. Photo by Captain Tom Greene

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

The DIGEST is an official Department of the Army periodical published monthly under the supervision of the Commandant, U. S. Army Aviation School. Views expressed herein are not necessarily those of Department of the Army or the U. S. Army Aviation School. Photos are U. S. Army unless otherwise specified. Material may be reprinted provided credit is given to the DIGEST and to the author, unless otherwise indicated.

Articles, photos, and items of interest on Army aviation are invited. Direct communication is authorized to: Editor, U. S. Army Aviation Digest, Fort Rucker, Ala. 36360.

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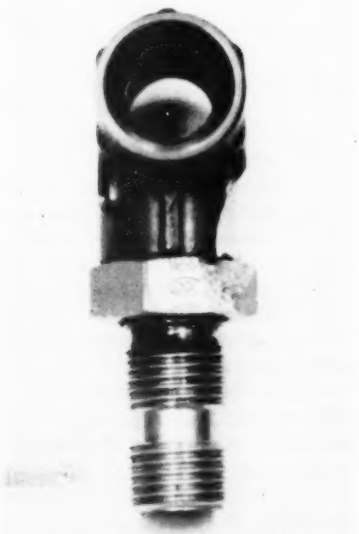
VIEWS FROM READERS

Getting out soon? Consider Reserve Component aviation. Write the DIGEST for a list of units in your state

Sir:

Our office has put out this message to our aviators and thought it might be of interest to your readers.

Reference: Hydraulic Failures Induced by the Chafing of Tubing and Various Plumbing.



Worn hydraulic fitting

The old theory of no two elements occupying the same space at the same time proves to continue to be true. Five inflight aborts have occurred at this command this calendar year due to chafed lines or fittings has pointed up the continuing hydraulic maintenance training requirements needed to maintain vibration inherent helicopters.

Mike Milo
Quality Assurance
U.S. Naval Safety Center
Norfolk, Va. 23611

★ ★ ★

Sir:

The U. S. Air Force maintains a physiological training program which has a vital interest in aircraft accident prevention and aviation medicine. Here at Tyndall Air Force Base, an average of two thousand students are trained annually. It would be quite beneficial to be able to review your magazine for current items of interest and reference material for classroom instruction. Please consider placing this organization on your distribution list.

CMSgt Joseph H. Nix Jr.
Superintendent,
Physiological Training
USAF Hospital
Tyndall Air Force Base, Fla. 32401

• We are sorry that we cannot fill your request since distribution is not handled by the DIGEST's editorial office. Air Force personnel desiring to receive the DIGEST or increase distribution should submit request to Headquarters, United States Air Force (AFDASDC), Washington, D. C. 20390.

★ ★ ★

Sir:

I have just read the August 1971 issue of your great magazine. When in the states, our squadron had a subscription and I enjoyed each and every issue but this is the first issue I have seen since arriving in Vietnam last May.

What really caught my eye was "The Armed Helicopter Story—Part II."

At present I am the senior helicopter advisor to the VNAF 2d Air Division. This division has two UH-1H squadrons with a new one to be formed soon.

If at all possible I would like to obtain five sets of the magazines containing the Armed Helicopter Story. I believe this whole story would make excellent reading and reference for each VNAF squadron.

LTC John M. Slattery
AF Adv. Gp. (AFAT-2)
APO San Francisco 96205

• Thanks for your letter, Colonel, your magazines are in the mail.

Continued on page 16

Army Aircraft Vulnerability And Survivability

Lieutenant Colonel Francis I. Lopes

PREDICTING survivability of Army aircraft is a difficult business. This is particularly true of survivability forecasts in a European environment, and it is clearly the most frequently challenged aspect of any airmobile concept proposed for the 1970-1980 time frame.

But before venturing deeper into the vulnerability and survivability realm, it would be well to review the distinctions between the two terms as described in AR 310-25: *aircraft survivability* is its capability to withstand enemy actions, material deterioration or the effects of natural phenomena which singularly or collectively result in loss of its capability to perform the mission(s) for which it was designed; *aircraft vulnerability* is its susceptibility to crippling damage by natural phenomena, equipment failure and any and all enemy countermeasures which may be employed against it.

Aggressor (far left) zeros in on the Cobra at upper right of photo. His weapon: a Redeye air-to-air missile

Although questioned by many, there is much confidence among Army planners that airmobile formations can survive in mid-intensity combat. The degree of survivability and extent of combat effectiveness has not been confirmed with the precision and assurance desired, but certain indications enhancing survivability are becoming apparent to the U. S. Army Combat Developments Command (CDC). For example, tactics (techniques) and features of aviation materiel which offer distinct possibilities for improving aircraft survivability are:

- Terrain masking and cresting techniques which appear to be a feasible and effective means of reducing vulnerability of helicopter gunships while engaging ground targets.
- Electronic intelligence and other gun location methods which allow Army aircraft to avoid enemy air defense sites.
- Infrared (ir) suppression devices which reduce aircraft vulnerability to ir weapons.
- Electronic countermeasures (ECM) devices, which have become sufficiently practical in terms of size, weight, effectiveness and power requirements to warrant their inclusion in Army combat aircraft.
- Reduction of helicopter noise, thereby reducing the capability of air defense systems to acquire these aircraft.
- Nap-of-the-earth operations, which reduce enemy air defense effectiveness by a substantial margin.
- The natural difficulty high-performance fighter aircraft appear to experience during attempts to locate and engage helicopters, especially in a European-type environment.
- Improved armor, reduction of vulnerable areas and aircraft

Artist's concept of helicopter air-to-air duels

system redundancy, thereby reducing aircraft vulnerability.

• Improved suppressive fire weapons such as that envisioned for the advanced aerial fire support system (AAFSS) and new artillery weapons with extended ranges and greater lethality.

• "Standoff" weapons of the TOW variety and launch-and-leave weapons similar to Maverick. Combined with nap-of-the-earth flight, standoff weapons permit minimal attack flight profiles which effectively limit the number of enemy guns capable of engaging helicopters.

Army analysis of aviation IRCM and ECM devices, attack helicopter weapons systems and the mode of operation they permit in combat zones indicates the helicopter can indeed survive and fight effectively against an adversary equipped with sophisticated weapons. However, in order to develop a more precise projection of the survivability problem CDC is conducting studies and experiments which will clarify vulnerability/survivability estimates. Employment of attack helicopters to defeat armor is one such study. The most comprehensive of these studies, however, is entitled "Airmobility in the Mid- and High-Intensity Environment," or short title "AM/HI."

AM/HI is essentially a follow-on action from an earlier study, "Aviation Requirements in the Combat Structure of the Army," or "ARCSA II." A large effort, the AM/HI study was conducted in three phases, although the area of interest this article investigates is limited almost exclusively to phase I: vulnerability and survivability.

Phase I had, as its overall objective, the development of an extensive vulnerability/survivability analysis of preselected Army aircraft. This effort was organized into four subtasks:

• Air-to-air vulnerability analysis.

• Nuclear vulnerability analysis.

AH-1G HueyCobra armed with Redeye air-to-air missile

• Aircraft vulnerability analysis.

• Ground-to-air survivability analysis.

From these subtasks a broad data base was accumulated and utilized as input to AM/HI phase III (war games) and final study evaluations. Let's take a brief look at the status of each subtask.

Air-to-air vulnerability analysis has been completed, to include the necessary reviews. The analysis produced a usable air-to-air computer model which was used in AM/HI's study evaluations and analysis. In addition the study identified and discusses in detail the empirical data required to produce a more refined air-to-air engagement model. In recognition of the shortcomings identified and in order to obtain the empirical data desired, the requisite field experiments were authorized by Department of the Army and conducted by CDC in CY 1970.

Vulnerablility of Army aircraft to the effects of nuclear weapons also is complete and has been published. The publication is basically a compendium of tables showing Army aircraft "sure-safe" and "sure-kill" zones under tactical nuclear conditions. This data was essential to war games executed for the AM/HI study.

Vulnerability analysis is essentially an evaluation and computation of aircraft vulnerable areas to specific ground-to-air air defense and small arms weapons. Of the four vulnerability/survivability subtasks mentioned, it is perhaps the most thoroughly validated area of analysis. The analysis is complete and vulnerability tables for each aircraft of interest in the AM/HI study are now available for other uses. The tables are based on meticulous scientific examinations of aircraft components and systems and their susceptibility to damage or destruction from various threat weapons. Empirical findings derived from laboratory firing tests are an inherent part of the vulnerability tables. Firing tests are performed with the actual threat weapon or approximated by using weapons of similar design when the real weapon is not available. The collected data permits a probability of damage, destruction or forced landing to be statistically forecast when aircraft are taken under fire by threat weapons whose technical characteristics are known.

Ground-to-air survivability analysis is directly dependent on, and an outgrowth of, the vulnerability subtask covered in the paragraph above. The vehicle for this analysis is fundamentally a computer model named Evade II by its originators. This unique model is capable of resolving in great detail the special acquisition and engagement problems of air defense weapons deployed against aerial targets flying at nap-of-the-earth altitudes. Modeled after existing hardware, electronic countermeasures, aircraft ir emission and its suppression are included to determine their effects on aircraft attrition.

Target detection, gunner reaction, gun aiming errors, ballistic accuracy, probability of hit and probability of kill are all assessed as computerized routines based on laboratory data and field experiments. The military potential tests and laboratory results of actual weapon firings are some of the sources of empirical data. Additional field experiments are currently planned, however, and the new experiments will among other things permit the gauging of the level of precision with which the Evade II model simulates these ground-to-air engagements.

A series of four such experiments were planned by CDC and three have already been executed by the Combat Developments Experimentation Command (CDCEC). A fourth was scheduled to begin in September. Each is designed to fill specific data voids although all

An AH-1G Huey Cobra lands at California test site

are expected to complement and confirm varying aspects of helicopter survivability analysis.

The first experiment, a ground-to-air test, was completed in July 1970 by CDCEC and provides empirical data concerning the susceptibility of helicopters to detection at nap-of-the-earth flight altitudes by a variety of antiaircraft weapons sensors. In addition, the effects of weather, visibility, topography, operating altitudes and man-machine incompatibilities have been evaluated and reported. The final report has been published.

The second experiment of the series, the air-to-air test was completed in 1970 with Navy cooperation and provides data on the susceptibility of attack helicopters to acquisition and engagement by high-performance fixed wing aircraft or other attack helicopters. It is well to bear in mind that air-to-air combat between helicopter and fixed wing fighters or other helicopters was a comparatively unexplored area. As a consequence, it was necessary for CDCEC and the Navy to accomplish some preliminary testing before executing the main experiment. Nonetheless, these tests yielded data which appears to confirm Israeli experience during the 1969 6-day war and results of recent British and German experiments with helicopters versus jet fighter aircraft.

Based on actual combat encounters, the Israeli Air Force expresses confidence that helicopters can evade jet fighters with great facility and ease. The Israelis emphasize that their evasive tactics were conceived independently and provided to their helicopter pilots during flight training prior to the beginning of hostilities.

In a British experiment called "Sparrow Hawk," fighter aircraft attempted to acquire and engage helicopters flying at low altitudes over rolling terrain. Fighter crews reported considerable difficulty in locating these helicopters. Moreover, this difficulty persisted even when fighter crews were vectored to the approximate location of the helicopter. In their evaluation the British have taken special note of substantial test delays caused by poor weather which grounded their fighters, although not their helicopters. This was particularly significant in view of the fact that their helicopters were equipped with only common navigation instruments and no optical target sighting devices. None of the newer surveillance and target acquisition devices were used (West German field experiments have produced data which corresponds closely to the British experiment).

In CDCEC exploratory tests helicopter sightings by fighter crews could not be readily made. If sightings occurred they were frequently caused by re-

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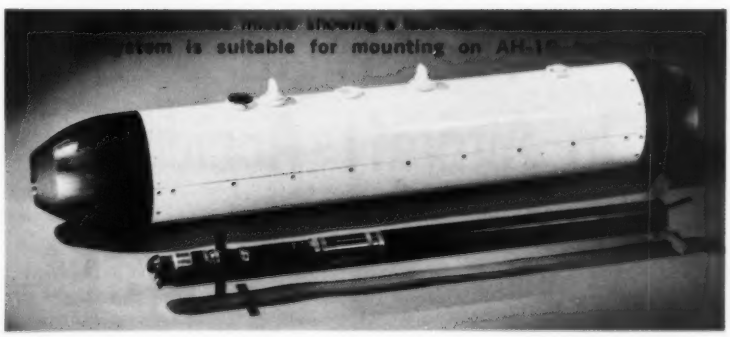


Aeromedic

Major Nicolas E. Barreca, M. D.

Provided by the Society of U. S. Army Flight Surgeons

The Flight Surgeon's Role In Aircraft Accident Investigation

The flight surgeon's participation in aircraft accident investigation is frequently misunderstood. Often the air crewman sees the flight surgeon's role as a last ditch effort to ground an unsuspecting defenseless aviator. This is far from the truth

To the air crewman: In a general sense, aircraft accident investigation is not uncommonly misunderstood by *some* of all those engaged in the process. A commander sometimes looks upon it as a threat, likely to reveal some weakness in his otherwise infallible countenance. The members of the board occasionally bellow in righteous indignation of the obvious stupidity and inconsideration invested in the aerial misadventures of their contemporary aviators. Meanwhile, the accused is often a victim or a scoundrel, whether or not he survives the accident. In a similar sense the flight surgeon's participation in an aircraft accident investigation is either misunderstood or perplexing to say the least. Not infrequently it is the flight surgeon himself, having had limited training, inadequate experience and harboring personal inhibitions, who misinterprets his contribution to this sometimes distasteful task.

To say that the flight surgeon may be perplexed is often to say that the air crewman is downright bewildered. He thinks, "Why isn't ole Doc at the clinic seeing my kids instead of wasting his time out here?" or "He's gonna get that blankety-blank pilot *grounded* one way or the other." Is that what the flight surgeon's participation in an aircraft accident investigation is all about . . . an opportunity to shirk more important duties? . . . . One long sought after or final opportunity to *ground* an unsuspecting, defenseless aviator?

Recently, a somewhat more inspired instructor pilot was indulging in similar intellectual speculation, while patiently pondering questionable aircraft availability, maintenance personnel shortages, weather minimums, a sick child, an unfulfilled wife and a ne'er do well student pilot. He ironically concluded that the flight surgeon's participation in the accident investigation was to determine what killed the victims of that tragedy. Well perhaps that says a lot more than appears on the surface, but must we limit our observations to "victims" . . . to those accidents involving fatalities or even injuries? Perhaps it would be physically and emotionally less costly to all involved if we learned our life-saving lessons from the survived accidents. An aircraft accident investigation, whether it be of a minor or major variety often "opens eyes" . . . it increases our observational powers, changes our perspective, makes us more objective. Often the work or operational environment enables us to take many things for granted, pushing the unlikely into the improbable, one recognized into

the imponderable and the infrequent into the never.

But what about our "friendly fright scourgeon," where *does* he fit into the act? As many an experienced aviator will tell you, often the real breakthroughs in an accident investigation are made by a conscientious flight surgeon. His areas of contribution are many sided and often depend upon his knowledge of man's physical and emotional *capabilities* and *limitations*. Too often the members of a board are sufficiently satisfied to settle on the concrete aspects of mechanical failure that they fail to reflect on some of the conditions that might have enabled early detection of that failure or permitted the pilot and crew to survive in spite of the disaster. Too often the board turns to pilot error, "He failed to take timely corrective action." How much can we learn from these conclusions? The questions should be, "Did the pilot receive adequate training to minimize this risk or make timely corrective action more likely?" "Does the pilot receive sensory informational outputs that enable him to detect a rapidly deteriorating situation soon enough?" "Has the pilot been realistically taught his judgmental or physiologic limitations or has he been falsely led to believe that his ability to fly in a school environment will cover him for all contingencies?" "How much does a pilot know about spatial disorientation or orientation error? About visual illusions? About operational or psychic fatigue?"

These are some of the many areas that concern the flight surgeon. Perhaps the flight surgeon can contribute in an untold fashion to the full realization that can come from aircraft accident investigation board findings. Let's look at the many concerns of a flight surgeon in aircraft accident investigations.

• *He establishes the nature and cause of injury or death.* Was there pre-existing disease or disability that contributed to the occupant's injury or death? Was there otherwise unrecognized injury as a result of hostile actions? Were deceleration or crash injuries inflicted? Did postcrash factors play a role in injury, its complication or death? . . . Entrapment? . . Fire . . Failure of rescue or survival? Only the flight surgeon can answer these questions satisfactorily.

• *He determines or confirms methods that improve crash survival to minimize future injury or death.* Was adequate personal protection available or utilized? Was the cockpit delethalized to prevent injury? Were seats and restraints designed to minimize crash forces? What about avoidance egress . . . the opportunity to leave the scene . . . possible, desirable, executed? What factors dictate man's survival in the face of known postcrash factors? The flight surgeon is trained to know the conditions that will minimize crash injury in the face of man's known tolerance.

• *He reconstructs the crash sequence.* By examining the distribution of victims and their injury pattern, the flight surgeon can often aid the other board members in understanding the sequence of events that prevailed during the accident. Only through such reconstruction can the likely cause of the accident be truly realized.

• *He determines the extent to which medical factors may have caused or contributed to the accident.* Was pre-existing disease or injury a factor? Did environmental factors play a role, such as hypoxia? Were toxic vapors involved? Were there emotional factors? How about man's inherent limitations . . . physical, psychological, environmental, performance-wise . . . ?

• *He evaluates the application and utilization of human factors design engineering principles.* Were the instrument panels, controls and flight procedures within the envelope of safe human performance. Often flights in some antiquated aircraft are doomed to failure, but for the gallant and exhaustive efforts of their well-trained crews. However, ultimately the right combination of collective failures, no matter how individually minor, will exceed the perserverence of even the best intentioned crew.

• *He identifies the victims.* Medical and dental records enable the flight surgeon to perform this essential task for both civil (insurance, estate, compensation, liability) and criminal (sabotage, homicide, suicide) reasons.

• *He contributes to research and education.* Regretfully, it is often by our mistakes that we learn. Sometimes only the evaluation and analysis of repetitive events (research) will permit understanding of the true risks undertaken by air crewman.

Aviators seldom purposefully set out to crash aircraft. Using the potential energy in aircraft for suicidal purposes is an infrequent occurrence in the military environment. Thus, in investigating an accident, board members must make every effort to uncover even the most subtle clues of impaired or compromised performance. Granted, a certain number of aircraft accidents result from poor judgment, inconsideration, indifference and poor physical or emotional aptitude for flying. However, even in these cases a responsibility is

incurred by the accident board. They must determine how this type of individual managed to be undetected by so many well meaning instructors, commanders, flight surgeons and safety experts. Thus, there are few if any simple, straightforward, open and shut, pilot error accidents.

Thus the flight surgeon can contribute extensively to an aircraft accident investigation board. His primary motive is to prevent the future injury and death of air crewmen. Secondarily, he assists in developing attitudes and practices that will reduce even minor accidents to a minimum. Perhaps then, the flight surgeon's neglect of other duties during an aircraft accident investigation will prove of inestimable value. It could enable a crewman's family to realize the vivid and healthful love, care and affection of a living sponsor and parent, rather than death benefits, gratuities and the sympathy of a flight surgeon who simply couldn't see the challenge of aircraft accident investigation or was prevented or discouraged from doing so by seemingly well meaning commanders and patients.

To the flight surgeon: A recent study performed by the U. S. Army Aeromedical Research Laboratory (USAARL) examined the accountable human costs of aircraft accidents in terms of loss of services from death or injury, treatment and convalescence. In one fiscal year, it was found that these costs exceeded 50 percent of the costs for material loss. In all probability, they approached or exceeded material costs since minimum figures were used from all aspects. It is lamentable that one must reflect on human life in financial terms, but too often these are better understood by the taxpayer than medical claims of the "inestimable value of health or human life."

It is clearly evident from USAARL's study that the flight surgeon can reap vast savings in human life by participating knowledgeably and diligently in aircraft accident investigations.

The first thing to be considered by the flight surgeon should be pre-accident arrangements. He must be prepared to react immediately when an accident occurs. Notification procedures and transportation must be planned. He must have flying apparel and treatment and investigation kits readily at hand. Prior arrangements with a pathologist, radiologist and local coroner or medical examiner authority will often facilitate early and fruitful examination of fatalities.

Once an accident occurs, it is essential for the flight surgeon to go to the accident site. Seldom will his emergency medical treatment services be required in the face of responsive aeromedical evacuation services. However, he must arrive early if he is to see the tangled relationship of wreckage and fatalities. In his evaluation of the wreckage he must think of injury causation and human engineering deficiencies as well as accident causation. All restraints and protecting equipment must be examined and evaluated. Lethal aspects of the cockpit environment must be considered as well as the design in adequacies of instruments and controls.

Upon returning to the hospital the thankless task of identification and autopsy and radiologic examination of fatalities begins. Such evaluation by the flight surgeon is essential if he is to truly recognize the factors of injury causation, injury prevention and possible medical accident causes. This evaluation must include a thorough examination of personnel protective equipment in the perspective of these examinations.

Once these initial time consuming procedures are attended, he must review medical records and interview those closest to victims . . . their loved ones, commanders, friends . . . for possible clues of emotional, psychological or performance factors. Finally all survivors must be examined and interviewed.

During the course of the board proceeding all gathered data must be integrated with other board member observations and witness statements. Ultimately this must culminate in a responsible and complete report of findings and recommendations. Thus, it is essential for the flight surgeon to participate fully in all the board procedures.

So the flight surgeon has his work cut out for him in the face of an aircraft accident. Often though, confronted by a nonfatal aircraft accident, his guard drops and he fails to reap the same benefits available from the analysis of a fatal crash. The same principles of investigation apply. Survivors must be examined with the same diligence and thoroughness as fatalities, if possible cause related dificiencies are to be identified. Protective equipment must be equally evaluated, but further, the flight surgeon must speculate upon what might have happened to potential occupants under slightly more serious conditions. Frequently it is the less serious or complicated accident which receives haphazard evaluations. Perhaps it is the understanding of this less costly experience that will prevent a future life devastating disaster.

The Freedom Bird

CW2 Eugene Reaves

I HAD BEEN A UH-1H aircraft commander for 5 months. With 60 days left in the Republic of Vietnam, I could almost envision that "freedom bird." I even felt a little invincible—I was short.

My pilot had 6 months incountry and was just about to make aircraft commander himself. We were good aviators, worked well together and I could vision sitting back, watching him fly the latter part of the mission.

At 0930 hours I took off enroute to the day's first troop extraction. I felt "great," the briefing had gone well, flight time probably would not exceed 3 hours and I was flying my favorite ship. It was the strongest flyable bird in the company.

After dropping the troops off at the landing zone we returned to pick up the six-man team we were to insert. I let my pilot take it; about to make AC, he could handle the remainder of the mission and I could make mental plans for the future.

My thoughts were a thousand miles away when the explosion occurred causing my pucker factor to red line. Had one of the Rangers discharged his weapon? My pilot must have had the same thought as we both looked in back to see what had happened. About then we experienced a hard yaw to the left and I felt as though the floor had fallen out from under us. An *engine failure?* Never happen—I was a double-digit midget.

My hopeful thinking was shattered by the heart-stopping sound of my low rpm audio and numerous lights on my caution panel. What to do? My pilot initiated autorotation; I put us up guard and took the controls.

About that time I was defeated by a comedy of errors, if such a cliche' can be used. "Put me up 2, put me up 2!" In my haste to take the aircraft I had neglected to put myself up UHF transmit.

Things seemingly began to move in slow motion although the duration was mere seconds. My pilot's hand took an eternity to move toward my radio, but why did it move toward the UHF radio instead of my control head?

"No, dammit, 2 transmit, 2 transmit!" He got the idea because finally (10 years later) I was able to transmit.

"Mayday, Mayday, Mayday, 083 going down 2 miles east of Whiskey Mountain with an engine failure!"

Who needed a radio? The way I screamed I could easily have been heard without ever keying my mike.

After three transmissions I listened in hopes an aircraft in the area would acknowledge my call and offer assistance. It seemed everyone in Vietnam had the same idea. I received the high pitched squeal caused by a number of transmissions on the same frequency. Finally an aircraft from my unit came on the air, "Got you in sight 083, I'll follow you down, be cool, be cool!"

"Rog, I'm cool!" What else could I have said?

As the earth sped up in my direction I had the feeling I was going to miss my area. I had no desire to go into the trees, particularly with six pax onboard, and I had neglected to pick an alternate area.

I applied aft cyclic in hopes my forward air speed would be slowed enough enabling me to make the area. It slowed all right, from 80 right down to 50 to 60 knots at 200 feet. Control movement had become very sluggish and exaggerated. To compound the situation I unknowingly pulled collective pitch. Right on!

Ground contact was rough. It was a semicontrolled crash. The skids had somehow made it up to eye level. Only then did I remember to shut off my fuel and electrical system switches. Opening my door proved impossible with my armor plate forward; I then resolved to get out between the seats.

Ten people walked away unscratched and some have said that because of that fact it was a good autorotation. But was it?

The cockpit of a Huey requires teamwork. The air commander and the pilot must know who does what and when. Things like altitude, air speed, rpm and N1 should be read off. When touchdown is imminent fuel and electrical system switches should be shut off.

Don't wait for emergencies to become proficient in emergency procedures. Flying requires 100 percent of your attention—when flying *think* flying.

This is a war story with a different ending. There were no heros, just two combat aviators who were not completely versed on teamwork and aircraft handling in an emergency situation. Don't let something like this happen to you. Complacency in one's duties is bad enough on the ground, but in the air it's deadly.

The "Raven" Flies From Wolters Nevermore...

Over 2.5 million flight hours have been logged by the OH-23 Ravens at the Army's Primary Helicopter School, Ft. Wolters, Tex. The 1956 photo above shows one of the Army's primary helicopter trainers departing a pinnacle landing area in the valley northeast of the Wolters main heliport. Countless students have learned the rudiments of helicopter flight and have a great respect for the "Old Reliable" OH-23. The Ravens also did their thing logging countless hours in combat under the strains of the Vietnam escalation during the last decade. The photo at left shows a Raven at the Tan Son Nhut, RVN, heliport in 1966. The Ravens served as scout ships during the mid-60s providing the eyes in the sky for commanders of units such as the 101st and 82d Airborne Divisions, as well as the three-quarter cav of the 25th Infantry Division and others. The Raven had its baptism under fire during the Korean War. The OH-23s helped establish the helicopter medical evacuation concepts in the Korean War. As the OH-23s leave the Army's primary training fleet a new page of history begins in the proud heritage of Army aviation with the versatile Raven joining the growing aircraft inventory of the Reserve Components

Mrs. Frances Marquess
Staff Writer
Public Information Office
U. S. Army Primary Helicopter Center/School
Ft. Wolters, Tex.

TIME WAS WHEN the skies around the U. S. Army Primary Helicopter School at Ft. Wolters, Tex., were filled with several different types of helicopters, and residents would cock an ear and then scan the skies to identify the type of aircraft.

No more. The OH-13s and the CH-34s have departed, and the last OH-23 has been flown away to join the Army Reserves. Left only are the Hughes TH-55 training helicopters and the Bell UH-1 Huey air crash rescue ships.

Now almost anyone can identify a passing helicopter by sound alone for no one could mistake the high-pitched whine of the TH-55 for the businesslike "whap-whap" of the UH-1.

The OH-23 served with special distinction at Ft. Wolters. The first of the Ravens arrived at Ft. Wolters in 1956, soon after the Army resumed command of the post. The last two OH-23s were flown to Army Reserve units in August. The OH-23 fleet at the Primary Helicopter School once numbered 418 and logged more than 2,565,800 flying hours. Countless students learned the basics of helicopter flight in the antiquated but reliable Raven.

Perhaps the most famous of the OH-23s was "Old Reliable," number 57-3007. The aircraft arrived at Ft. Wolters factory-new and logged 10,377 hours before being flown to the 99th Signal Battation, a Reserve unit in New York City. During its service at Ft. Wolters "Old Reliable" was not involved in a major accident and had only one incident with just $232 damage.

The OH-23 was manufactured by Hiller Aircraft Corporation and was accepted by the U. S. Army on 11 July 1958. Southern Airways flight commander, the late Lloyd Wilson, completed the ferry flight from Palo Alto, Calif., to Ft. Wolters 4 days later and the ship went to work (Southern Airways is the commercial flight training contractor at Ft. Wolters). Most Wolters pilots have great respect for "Old Reliable" and her sister aircraft.

"Old Reliable" number 007 (right) logged more than 10,000 accident-free flying hours at the Primary Helicopter School. Below left: CWO Frank Thompson (left) who flew the first OH-23 to Ft. Wolters in 1956 bids farewell to CWO Ken Kalahar as he prepares to fly the last "Raven" to his Reserves unit in Des Moines, Iowa. Southern Airways officials W. S. Schwalm (right) and Jack Massey witnessed the event. Below right: An OH-23 Raven takes off for the Ft. Wolters parade field on the last military mission for the OH-23 at the Army's Primary Helicopter School

DON'T
GAMBLE...

...Listen To Common Sense!

Captain Lawrence A. Burnham

NOW THAT I am back safe and sound in the states I have time to sit back and think about my year in the Republic of Vietnam. Surprisingly enough I don't think much about my experiences or the number of close calls I had; I think about my close friends who lost their lives, not to hostile fire but to accidents. Sorry to say they were needless, preventable accidents that wouldn't have happened if the pilots had used a little good old common sense. I'll give you just a brief outline of a few of them, and you will see where common sense would have prevented each accident.

The first, I remember, was a midair between an AH-1G HueyCobra and a command and control (C&C) UH-1H. The Cobra was part of a gun team making gun runs on an enemy position. The C&C was carrying the commander of the ground outfit who told the aircraft commander he wanted a closer look at what the Cobras were shooting at. The UH-1H dropped down lower and moved over the target just as the Cobra was pulling up from his run. His wingman shouted a warning over the radio, but it was too late. The Cobra pulled up and hit the C&C from underneath, followed a moment later by a terrific explosion as both ships blew apart in midair. There were 9 lives lost just for a closer look.

C&C jocks should have enough common sense to keep their passengers advised that it is better to orbit away from the gunships and wait until they have finished their work before moving in to assess the situation. Gunship pilots don't have time to watch for other aircraft while they are concentrating on targets and enemy ground fire. This same type accident was repeated a few months later.

The second was a routine night resupply with two aircraft commanders at the stick on a routine night resupply. The landing zone was a wide open grassy area with a field elevation of 20 feet above sea level. They flew into the ground at 80 knots, 300 meters from their intended touchdown spot. Members of the unit they were resupplying said that they never saw the landing light come on. Speculation was that their altimeter was incorrect and they saw the gound too late. If they had turned on the landing light at 200 or 300 feet, they may have seen the ground soon enough and called it a close call at the most. The question is, Why wasn't the light on? There were no known enemy in the area and both aircraft commanders had over 9 months incountry. We'll never know the answer. But, you should have enough common sense to turn the light on in sufficient time to avoid a surprise that could cost you your life. And, check your altimeter every chance you get.

The third accident really didn't surprise anyone when it happened. We were all saddened at the loss, but we had expected it. The aircraft commander had a love for low-level, high-speed flight wherever he went. He was thrilled by it—and he was killed by it and took 10 people with him.

What was his accident? He flew into heavy steel cables that cross a river. Common sense says, "Don't low level anywhere unless the mission requires it." Common sense is the greatest thing you have and it makes a great copilot. All you have to do is remember to use it and listen to it.

Continued from page 1

VIEWS FROM READERS

extension of the controls and be as relaxed as possible. He cannot do this if he must suspend his arm in midair without the benefit of resting his arm on his leg. Any movement of the aircraft results in a movement of his arm and is therefore transmitted to the aircraft controls.

What can we as aviators do to correct or improve an aircraft design? For one thing we can make our thoughts and wishes known and if enough of us are vocal enough maybe someone will hear us that can influence the outcome.

LTC William W. Gahm
Army Advisor ARNGMO
Warrensburg, Mo. 64093

Sir:

As a dual rated Master aviator with more than 5,500 hours flying time with the U.S. Army, I have been a part of the "coming of age" of Army aviation. From my initial flight training in the old "rag wing" the old aircraft design has continually improved from the very basic aircraft to one of extremely sophisticated equipment and capability. The personal equipment improvements include the flight helmets and Nomex flight clothing. We have aircraft seats that are designed for maximum comfort and maximum protection in the event of a crash. The seat is normally adjustable up and down or fore and aft, or both. The pedals are adjustable fore and aft in most aircraft and in some aircraft are even power assist in the adjustment. The point of this buildup is that designers recognize that all aviators are not a standard issue size of exactly 6 feet tall and weigh exactly 186 pounds. The aviator's height may vary from 5 feet 4 inches to 6 feet 4 inches. Some have larger stomachs than others while some are blessed with longer arms. For these differences in size we have the adjustments as previously noted for pilot comfort.

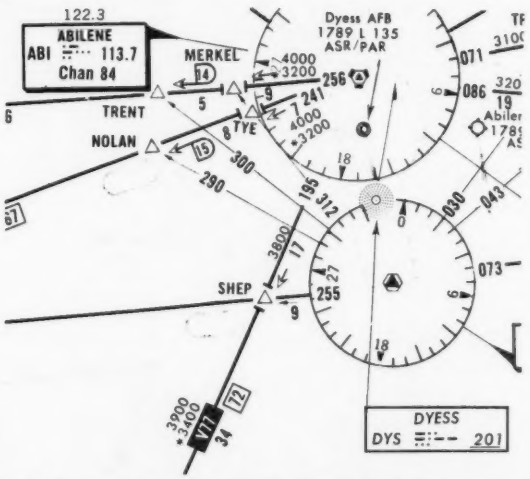
From all of my years of flying Army aircraft I find that there is one vital adjustment that could be incorporated into the aircraft design. The fixed wing aircraft would realize an advantage but the helicopter would be the real benefactor. I am referring to a vertical adjustment of the cyclic stick. This could be accomplished with a slip friction sleeve that would add very little weight to the aircraft. This would be a boon to the pilots that fly instruments or those that fly for extended periods of time. The medical aspects of this are also unlimited as it would reduce fatigue and considerably reduce the "helicopter hunch" position that most aviators find themselves in due to uncomfortable stick grip positions.

I am amazed that this problem has not been explored before as I have personally heard it discussed by hundreds of aviators throughout my career. As a rotary wing instrument examiner, I am quite aware that a pilot must become an

INSTRUMENT CORNER

Q. While flying IFR to Dyess AFB on V77, I received a clearance to Shep intersection (short of my destination). I arrived at Shep without further clearance. Should I have held south of Shep on V77 or held in the published holding pattern?

A. You should hold in the charted holding pattern. Reference: FLIP, section II, page II-78, paragraph III, Z, 2, c, dated 22 July 1971.



Q. What is the missed approach point for a precision approach?

A. The missed approach point is a point on the final approach course where the height of the glide slope equals the authorized decision height (DH). Reference: TERPS, page 74, paragraph 941, dated February 1970.

Q. What is the correct approach to execute at the destination under two-way radio failure?

A. If more than one approach fix is available at the destination, it is the pilot's choice and ATC protects airspace at all of them. Reference: Airman's Information Manual, page 1-70, paragraph 1, c, (3), dated August 1971.

The Armed Helicopter Story

Part V

Formal Development (Models XM-1 thru XM-50)

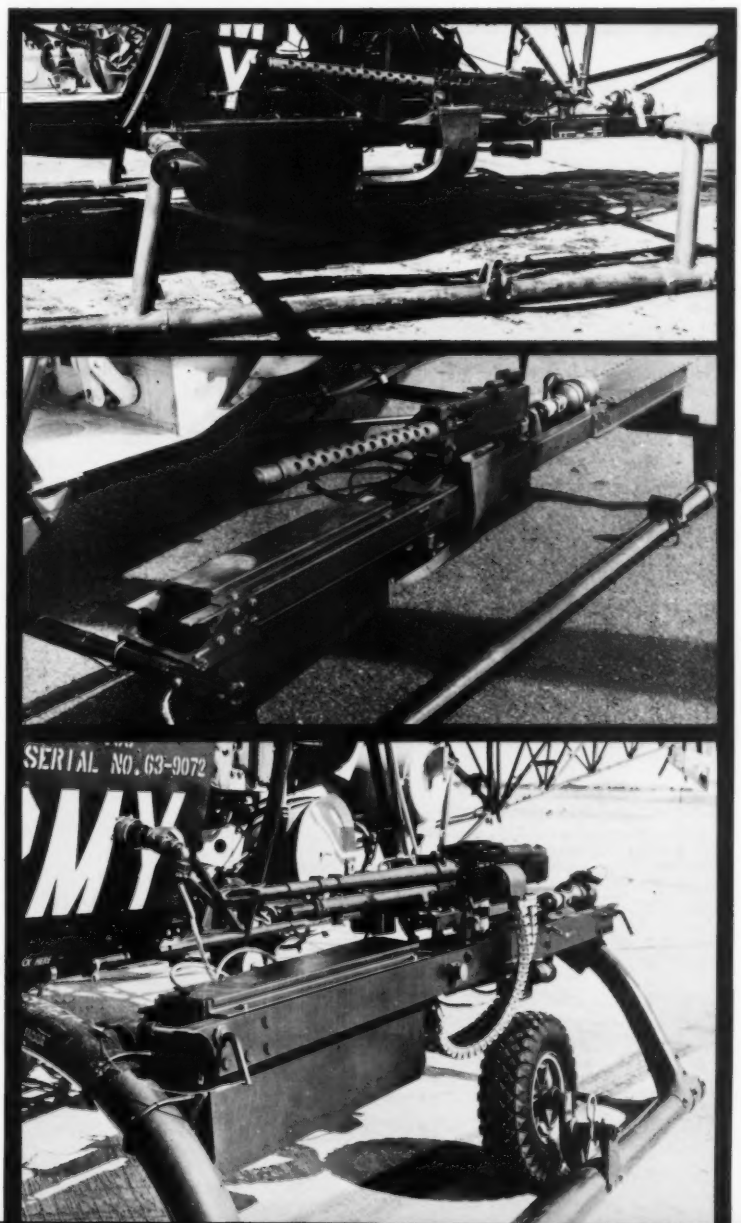
Lieutenant Colonel Charles O. Griminger

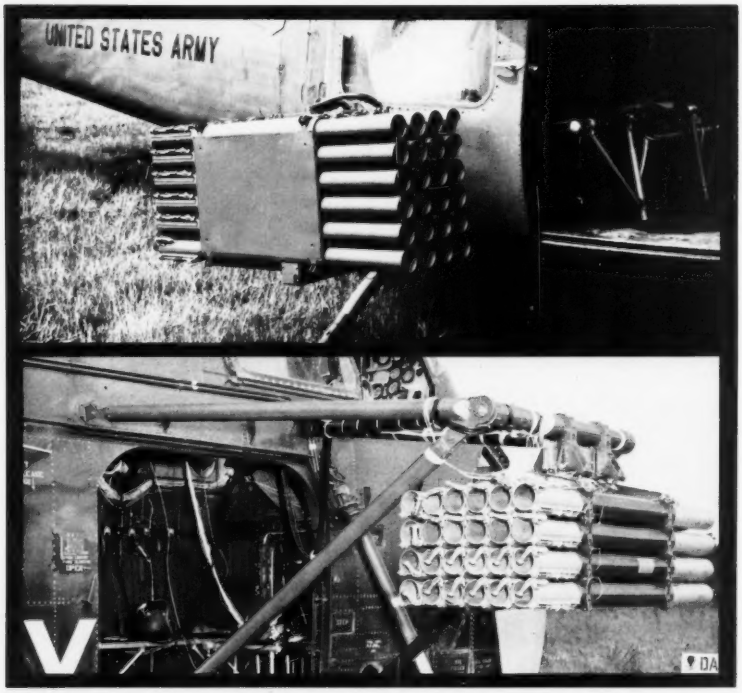
XM-1 (top photo, mounted on OH-13; center photo, mounted on OH-23D): Two .30 caliber M-37C (tank) machineguns (mgs); shots per minute (spm), 550-575; ammunition capacity per gun (A), 650 rounds; maximum effective range (MER), 1,000 meters; manufacturer (M.), 8305th ACR Co., Ft. Rucker, Ala.; tester (T.), Springfield Armory; aircraft developed for (acft), OH-13E, G & H plus OH-23D; nickname, Hammond kit (also see M-22).

M-2 (bottom photo, mounted on OH-13S): Two M-60C, 7.62 mm (NATO) mgs; spm, 500-650; A, 550 rds; MER, 1,000 meters; M., Springfield Armory.

Development of the XM-1 began in 1960 with the evaluation and adoption of the KX-13-A1-2 (see "The Armed Helicopter Story—Part IV"). It was to provide a means of suppressing enemy ground fire for the 1961-63 period. Limited production of 150 began in 1961, with 50 designated as the XM-1 and the remaining 100 as the XM-1E1. There were 200 XM-1E1's completed by March 1963. The XM-1E1 system resulted from recommended modifications to the XM-1 system after deficiencies were noted during tests in January 1962. The rigid chuting was replaced with flexible chuting and the angle side rail with box rails. The system completed tests by the U. S. Army Aviation Test Board at Ft. Rucker in August 1962.

The XM-2 kit underwent development tests at Springfield Armory in May 1962. The kit consisted of the XM-1E1 system mount modified for the 7.62 mm M-60C machine gun. The ACR Company at Ft. Rucker had accomplished experimental mountings of the weapon prior to the Springfield's work. The combined engineering service test of the system was conducted at Aberdeen Proving Ground and the sytem was standardized as the M-2 in November 1963.





XM-3: Two 2.75″ folding fin aerial rocket (FFAR) pods with 49.75″ tubes of 24 rockets each; MER, 3,000 meters; M., Redstone Arsenal; acft, UH-1B & C; nickname, Hog. This subsystem was designated XM-3E1 with 53.75″ rocket tubes. It also was combined with the M-5 to form the XM-3/5 (see **M-5**).

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XM-4: Two 2.75″ FFAR pods of 24 rockets each; MER, 2,000 meters; M., Redstone Arsenal; acft, CH-34; cancelled after the production of four systems.

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The XM-3 armament subsystem was the result of one of the Army's first funded programs for research and development to test the feasibility of Army helicopters. Development began in November 1960 on a system envisioned to be a flexible or automatically controlled subsystem. In November 1962 it was decided to produce a less complex version of the XM-3 on a crash basis.

Based largely on early experiments conducted in the ACR Company at Ft. Rucker, the 2.75-inch folding fin aerial rocket (FFAR) was determined to be the best available for the system. During April 1961 the Aviation Board tested a CH-21 helicopter armed with a 2.75-inch FFAR and determined that the system was suitable for helicopter armament. In August 1961 a CH-34 was equipped with a 2.75-inch FFAR system fabricated by the Army Ordnance Missile Command, Redstone Arsenal, Ala. The system, which became the XM-4, was used with a U. S. Navy Mark 17 sight and rocket launchers that were the first made to jettison in flight. The mounting arms for the rocket pods were originally developed by Ft. Rucker's ACR Company. The XM-3 for the UH-1 was under development while the CH-34 system was being tested. Although never type classified, the XM-3 was placed in limited production and by May 1963 was in use in Vietnam.

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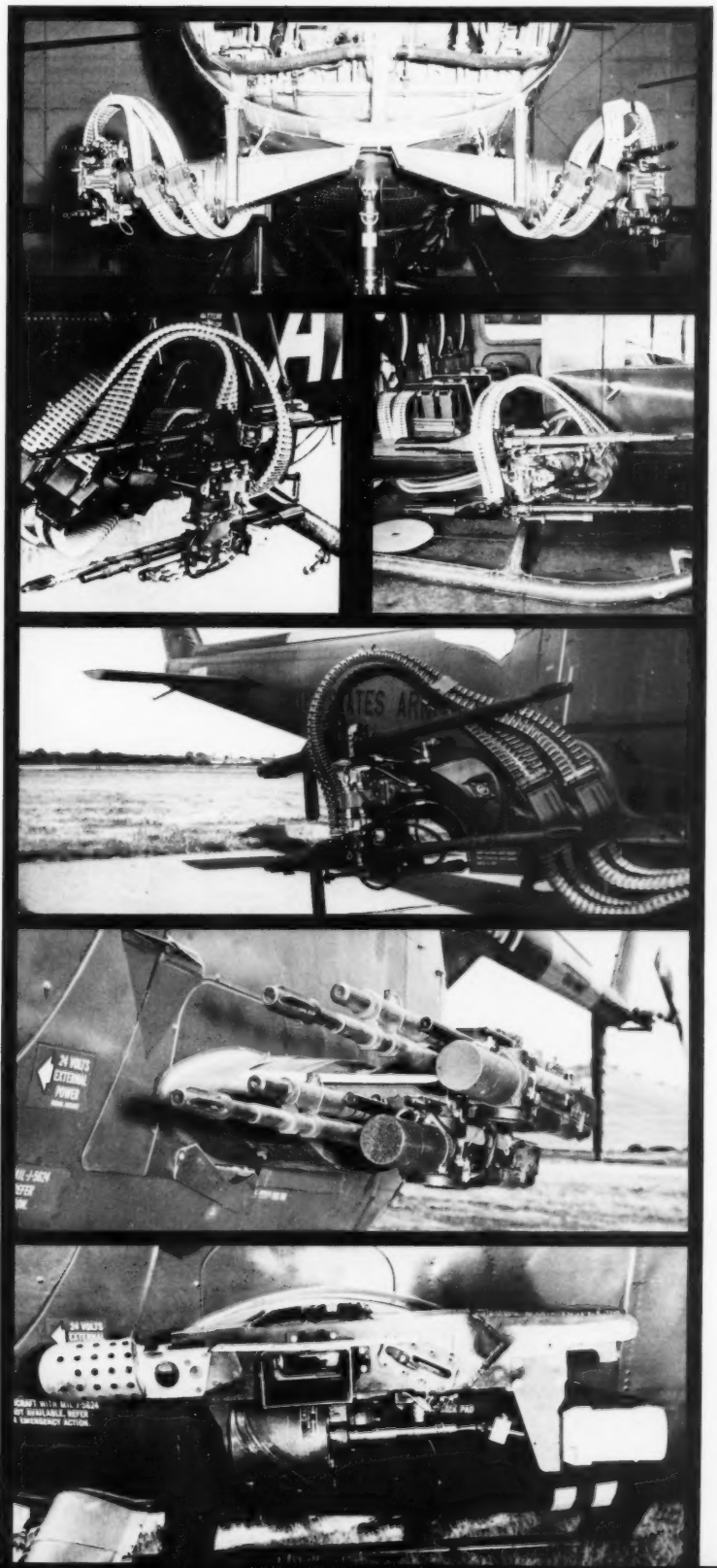
M-5: One M-75 40 mm grenade launcher, nose mounted; capacity, 150-315 rds; MER, 1,500 meters; spm, 220-240; acft, UH-1B & C; M., General Electric (contract awarded June 1966); development began 1963 with GE; type classified, 25 July 1964. Far left, nose view of M-5 on UH-1. Left, combination XM-5 and XM-3 (nicknamed Frog). The M-5 also was combined with the **XM-16** and **XM-21** systems (also see **XM-138**).

M-6 series

XM-6 (top photo): Four 7.62 mm mgs, side mounted; capacity, 6,000 rds total; MER, 1,000 meters; spm, 550-650 each; M., Emerson Electric Co.; acft, CH-21; type classified, May 1963; this system was designated **XM-6E1** on the CH-34 (second row, left), **XM-6E2** on the UH-1A (second row, right) and **XM-6E3** on the UH-1B (third row). The M-6 series, designed as a ground fire suppression kit, evolved from the Emerson quad machine gun system. It was originally designated the **XM-153** quad gun helicopter fire suppression system. It was mounted as the **XM-154** on the CH-21, as the **XM-155** on the CH-34 and the **XM-156** on the UH-1A & B. The system's designation was changed to the XM-6 series when the M-73 machine gun was found unsatisfactory and replaced by the M-60 (also see **XM-16**).



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XM-7: Two 7.62 mm mgs mounted on the left side of the OH-6. This system was replaced by the **XM-27.**

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XM-8: One 40 mm grenade launcher on left side of OH-6A; capacity, 150 rds; MER, 1,800 meters; spm, 230; this system later equipped with **XM-129** gun.

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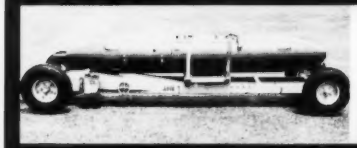
XM-9: Two M-75 grenade launchers, one pod mounted on each side of the UH-1B.

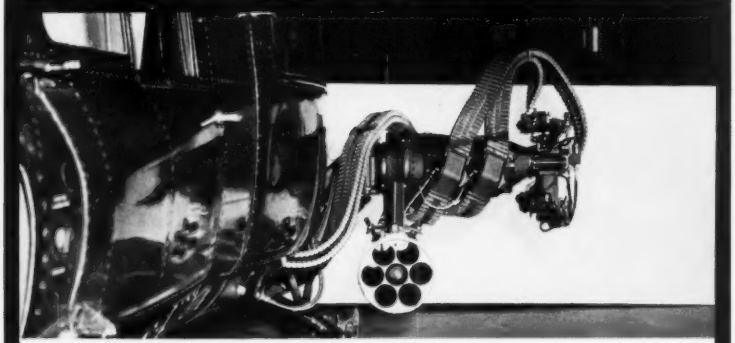
XM-10: Two M-60C, 7.62 mgs; designed to replace the M-2 on the OH-13 and OH-23, but was cancelled.

XM-11: Six SS-11 wire-guided missiles for installation on UH-1B (see **M-22**).



XM-14 (left): One .50 cal M-3 mg per pod, side mounted; capacity, 750 rds; spm, 1,000-1,100; acft, UH-1B; limited production.

XM-15: Two 7.62 mm miniguns for use on the UH-1B; project dropped.



XM-16 (left): Four M-60C, 7.62 mm mgs (the **M-6** mg system) and two each seven round 2.75" FFAR rocket pods; side mounted; capacity per mg, 500-650 rds; MER (mg) 1,000 meters, (rocket) 3,000 meters; M., Emerson Electric; acft, UH-1B & C; also combined with the **M-5**; formal development began May 1963; contract awarded Aug 1963; prototype delivered Feb 1964; versions of the XM-16 also were developed by the Utility Tactical Transport Helicopter Company in the Republic of Vietnam ("The Armed Helicopter Story, Part IV," Sep 1971 DIGEST, page 21) and by the U.S. Army Aviation School, Ft. Rucker (left).

XM-17 (no photo): Two **XM-159** nineteen tube or **XM-157/158** seven tube 2.75" FFAR pods for the UH-1B.

XM-18 (left): One 7.62 mm minigun per pod, side mounted; capacity, 1,500 rds; spm, 4,400; acft, UH-1B, AH-1G; limited production.

XM-18E1 (no photo): One 7.62 mm minigun per pod, side mounted; capacity, 1,500 rds; spm, 2,000 or 4,000; designed for AH-1G.

XM-20 (no photo): Two 7.62 mm **XM-134** guns; spm, 2,000-4,000; MER, 3,000 meters; acft, UH-1B; dropped.

XM-21: Two 7.62 mm **XM-134** mgs and two each **XM-157** or **XM-158** rocket pods for the 2.75" FFAR, side mounted; spm, 2,000-4,000; capacity, 3,000 rds (mg) and 7 rockets per pod; MER, 3,000 meters (mg) and 1,000 meters (rockets); M., Emerson Electric. This is the XM-16 modified by replacing the four M-60 mgs with two miniguns; it was service tested in 1965 and sent to Vietnam for tests in 1966; it also was tested with the M-5 system and designated **XM-50.**

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M-22 (right): Six AGM-22B wire-guided missiles; MER, 3,000 meters; acft, UH-1B&C; type classified, July 1964; first used in combat in Vietnam, Oct 1965; this system also was combined with the **XM-3** and the **XM-1** (also see **XM-11**).

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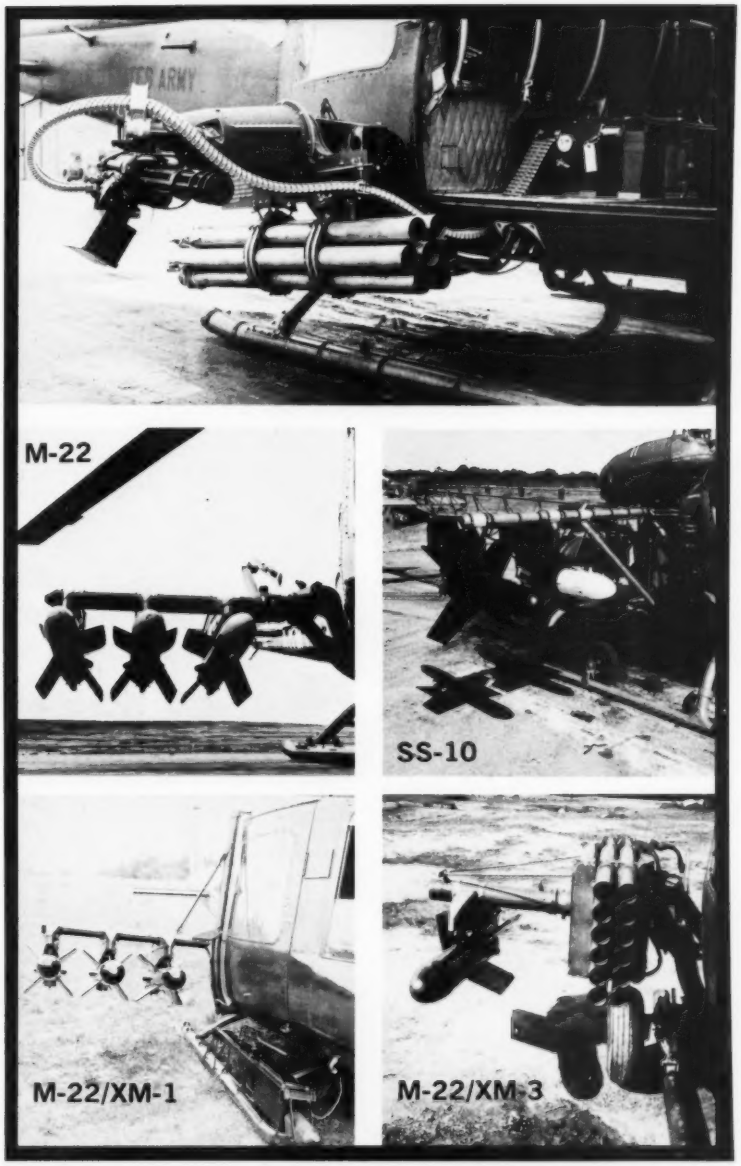
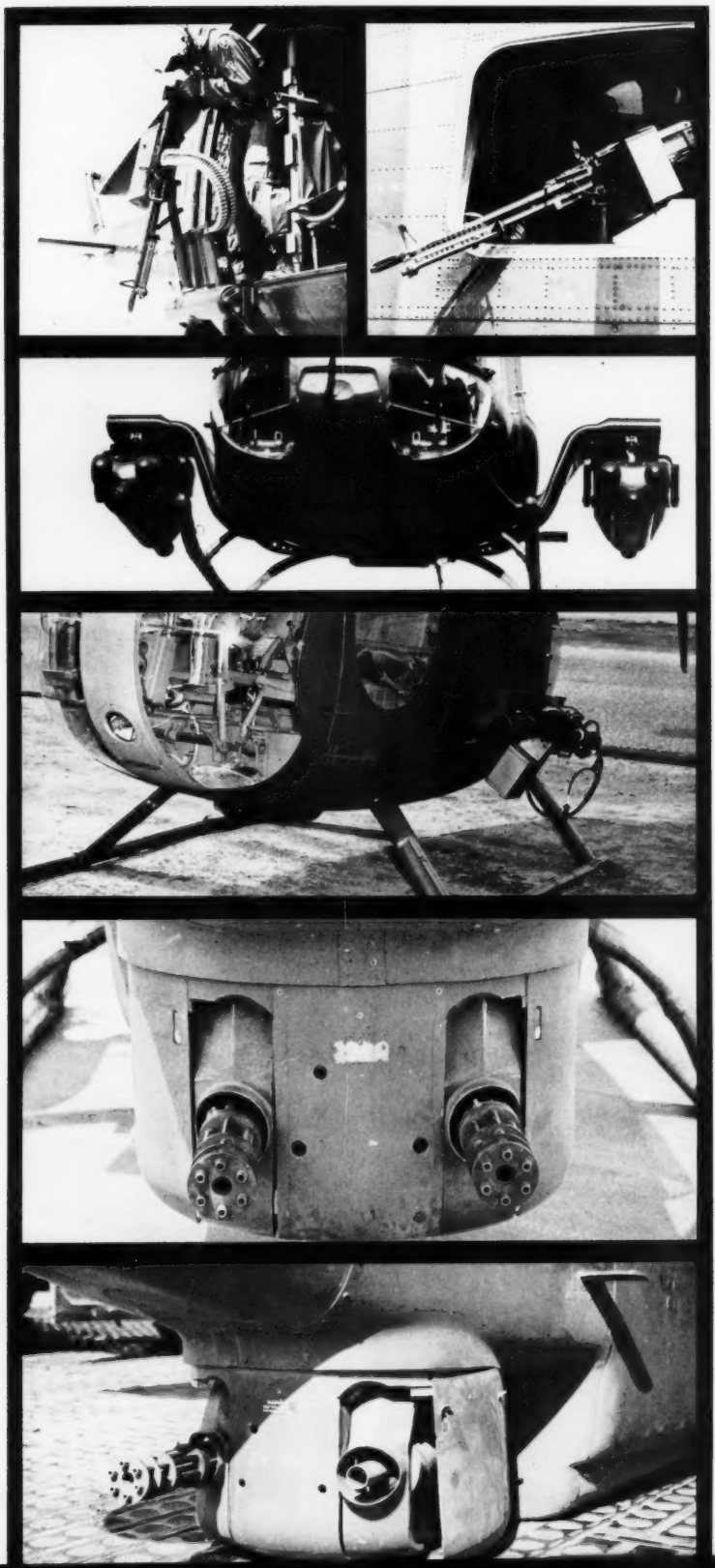


The U. S. Army's M-22 system had its beginning with France's successful use of the SS-10 and SS-11 missiles, mounted on helicopters, for combat operations in Algeria. The U. S. Army began planning for tests of the SS-10 antitank guided missile in 1958. The test plan called for the U. S. Army Aviation Board to test the SS-10 in the helicopter mounted role. The aviation members of the test team, 1LT Anthony Carroll, CPT Charles W. Jones and 1LT Robert W. Chedester, arrived at Camp de Mailly, France, in March 1958 to begin training at the French Army armor training center.

The U. S. test team returned to the United States and began to program for the SS-10 tests. By 15 August 1958 the Bell Helicopter Company had delivered two OH-13H helicopters armed with four SS-10 missiles each. Tests of the system revealed that with a few corrections it would be a suitable system for Army use. In February 1959 it was decided to hold further action on the SS-10 system until the SS-11 was evaluated. The SS-11 was designed primarily for the aerial role; it was heavier, had a greater range and a greater payload. The first service tests of the SS-11 mounted on the UH-1A helicopter were conducted on 1 March 1960. The installation of the SS-11 system had been completed by the Bell Helicopter Company in October 1959. It was concluded during these tests that the system would not be effective unless an adequate optical sight could be developed. Several systems were tried, including a U. S. Air Force P-61 sight which proved to be reasonably effective. The XM-55 sight was adapted for use until Textron's Bell Aerosystems Company delivered the XM-58 antioscillation sight.



M-23 (far left): One 7.62 mm M-60D mg, door mounted; MER, 1,000 meters; spm, 550-600; acft, UH-1D; former XM-23 developed by Springfield Armory; M., Sperry Utah; tested, 1964-65.

M-24 (left): One 7.62 mm M-60D mg mounted in the door or escape hatch of the CH-47; capacity, 200 rds; MER, 1,000 meters; M., Sperry Utah.

M-24A1 (no photo): 20 mm automatic machinegun; MER, 2,500 meters.

XM-26 (left): Tube-launched, optically-tracked, wire-guided (TOW) missile intended to replace M-22 system; acft, UH-1B & C and AH-56A; M., Hughes; system is computer directed.

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XM-27 (left): One 7.62 mm GAU 2B/A gun mounted on left side of OH-6; capacity, 2,000 rds; spm, 4,000; MER, 1,000 meters; M., Hughes; limited production; a lightweight version is designated **XM-27E1.**

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XM-28: Two 7.62 mm GAU 2B/A guns (top left), or two 40 mm XM-75 launchers, or one gun and one launcher (bottom left); turret mounted; capacity, 4,000 rds per gun and 30 rds per launcher; spm, 2,000-4,000 per gun and 400 per launcher; MER, 1,000 meters (gun) and 1,800 meters (launcher); acft, UH-1B and AH-1G; M., Emerson Electric; XM-75 replaced with XM-129.

XM-29 (no photo): 7.62 mm mg similar to **M-23**; door mounted in UH-1.

XM-30 (right): Two 20 mm **XM-140** guns, side mounted; spm, 425 each; MER, 3,000 meters; acft, UH-1B & C and AH-56A; M., designed at Springfield Armory to replace the **XM-3.**

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XM-31 (right): Two 20 mm **M-24** guns pod mounted on the side of the UH-1B or C; capacity, 500 rds per gun; spm, 700; MER, 3,000 meters (also see "The Armed Helicopter Story, Part IV," Oct 71 DIGEST, page 24).

XM-32 (far right): Mounts and ammunition boxes for four .50 cal **M-2** mgs or for 7.62 mm M-60D mgs, or any combination of these mgs; acft CH-47.

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XM-33 (no photo): One .50 cal M-2 mg or one 7.62 mm M-60D mg mounted on rear ramp of CH-47.

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XM-34 (right): Two 20 mm M-24A1 guns mounted on the side of the CH-47.

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XM-35 (right): Two M-61A1 20 mm **(XM-195)** guns; spm, 650-850; MER, 2,500 meters; one gun mounted on each stub wing of the AH-1G; tested in 1968.

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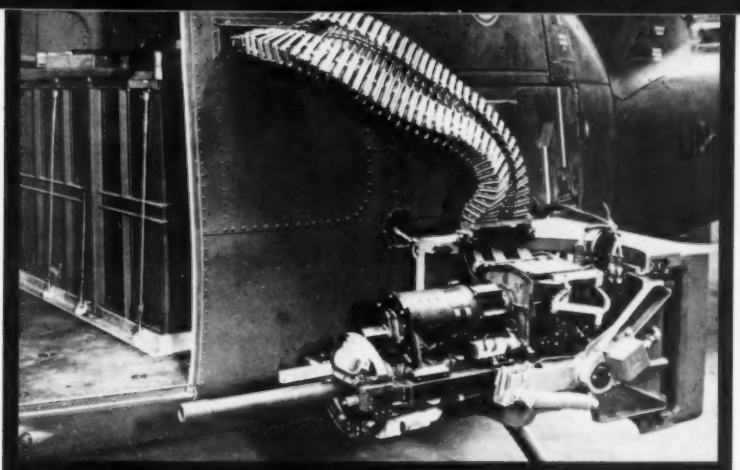

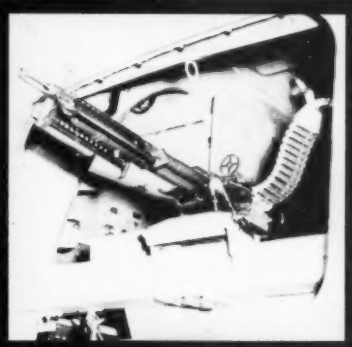

M-39 (right): 20 mm single barrel automatic gun mounted in cargo doors on each side of the UH-1B; spm, 1,500; M., Ford Motor Co. and Pontiac Corp. Produced during the period 1951-1960.

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XM-41 (right): One M-60D 7.62 mm mg ramp mounted on the CH-47; capacity, 200 rds; spm, 550; MER, 1,000 meters; initial test conducted in June 1967.

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XM-50 (right): Combination of the **XM-5** and **XM-21** systems on the UH-1B & C.

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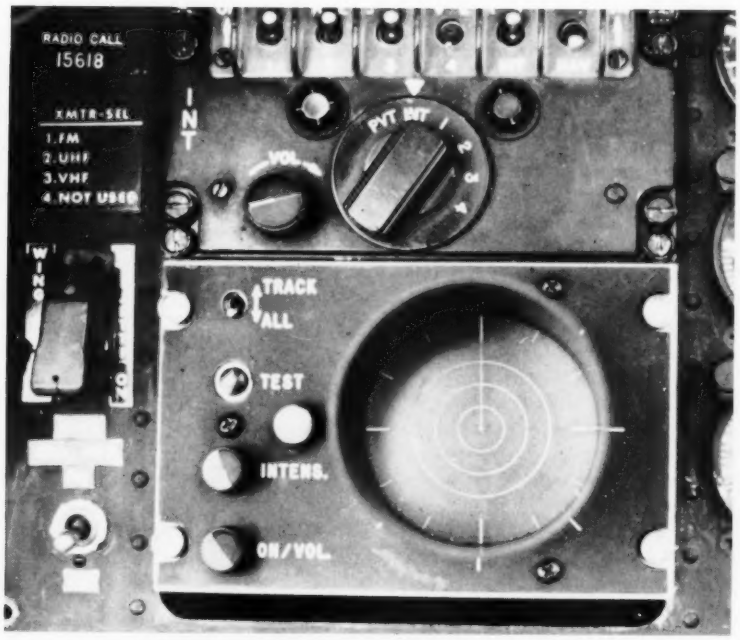
Next month the DIGEST concludes "The Armed Helicopter Story" with Part VI.

Army Aircraft Vulnerability And Survivability

Continued from page 5



Actual cockpit display, LAWS ECM hardware installed in an AH-IG attack helicopter

flecting sunlight from polished metal on rotor hubs or other similar bright surfaces. This difficulty is, of course, easily corrected and such action has been accomplished at the test site.

Noteworthy also is the fact that during preattack maneuvers fighter crews sometimes lost sight of their intended targets or failed to achieve a satisfactory firing pass. In the same test, on the other hand, helicopter crews—unlike the fighters—repeatedly demonstrated an ability to sight their potential attackers at the earliest opportunity. As a result they were permitted sufficient time to undertake defensive or evasive action.

In addition to the primary purpose of measuring the capabilities of opposing aircraft to successfully achieve air-to-air detections and execute attacks or defensive actions, tests permit measuring the probable attrition of enemy high-performance aircraft to friendly air defense fires under specific circumstances.

A third test is the "Basic Attack Helicopter Team" experiment completed 20 December 1970 at Hunter Liggett Military Reservation, Calif. This test furnished data for tactical and organizational concepts pertinent to the attack helicopter battalion. The test scenario portrayed a representative enemy armor/mechanized column, equipped with threat-type weapons and sensors, employed in a penetration maneuver. Tactical concepts and items of materiel designed to enhance helicopter survivability were tested and results have been included in CDC's overall survivability data collection effort.

A fourth experiment was scheduled to begin during September 1971 at CDCEC. The principal purpose of this new experiment is to determine tactics, techniques and items of materiel which maximize kill-exchange ratios of the attack helicopter team operating against tank-heavy ground elements. The experiment will employ attack helicopter teams in conjunction with combined arms teams deployed in a daylight defensive posture opposed by a tank heavy attacking force. Side investigations will examine the effects of ECM, stabilize magnification optics and scout to attack helicopter mixes.

Other attack helicopter experiments are in the offing as a continuing effort to develop an optimum organization and to refine techniques of employment for attack helicopters. Materiel offering the best prospects for optimizing survivability will be identified during this new series also.

In conclusion, it is interesting to note that in the past a large body of opinion predicted intolerable helicopter losses in the Republic of Vietnam where, in fact, loss rates for attack helicopters are less than those of fixed wing fighters. Although suggesting caution in employing penetration-type missions, CDC simulations and studies are affording optimistic evidence of the helicopter's ability to survive in mid-intensity combat environments.

Charlie and Danny's Write-In

RECENTLY in the April issue of the AVIATION DIGEST, Danny and Charlie advertised World Wide Life Insurance for all aviators that was low cost and contained no aviation riders.

We had numerous inquiries which indicated that you as pilots were concerned for your families and loved ones.

For those of you who didn't actually get around to sending for information about the low cost insurance and probably wonder what we had in mind, we would like to share our insurance policy with you as we did with the more inquisitive.

We are sincere when we suggest that to know and use the dash 10 and dash CL is good life insurance.

THE REMAINDER OF THIS POLICY IS AVAILABLE TO YOU IN ALL AIRCRAFT.
USE IT WITH OUR SINCERE WISH FOR A LONG AND PRODUCTIVE LIFE.
TM 55-15XXXX-XXXX-CL
DEPARTMENT OF THE ARMY TECHNICAL MANUAL
Operator's and Crewmember's Checklist
ARMY MODEL
Aircraft
Pilot's Checklist
HEADQUARTERS, DEPARTMENT OF THE ARMY

Dear Reader:

Your inquiry concerning low cost life insurance indicates you are an individual of forethought and concern for your loved ones. We are pleased to service your needs and include you among the thousands of satisfied customers whom we service daily.

This letter constitutes a binder of insurance subject to the following conditions:

a. That the insured is:

(1) Currently an aviator in the Armed Forces of the United States.

(2) Qualified or undergoing qualification in a military aircraft.

b. That the insured complies with the terms and conditions set forth within the policy (see inclosure 1).

Let me again welcome you to our evergrowing ranks of satisfied customers. Your loved ones will always remember your deep concern for their future as well as that of your own.

Sincerely yours,
Danny and Charlie

Dear Danny: I am a very enthusiastic fan of the AVIATION DIGEST. I especially enjoy your Write-In and Maintenance Matters.

I have recently been assigned to supervise maintenance of some U. S. Army model OH-13S helicopters. In some of these helicopters we have noticed that when the throttle is quickly closed from 3200 rpm to check

for rotor free wheeling the rpm drops to about 2000 to 2100 before stabilizing at about 2300. In a few helicopters when the throttle is abruptly closed during hovering autorotations, the rpm drops to about 1600 before stabilizing at about 2300 rpm. Since TM 55-1520-225-20 does not give any specific information on this subject, I am writing to you in the hope that you will be able to advise me whether these drops are acceptable. Would it be safe to carry out forced landing practice in a helicopter which exhibits this type of rpm drop?

Major Mohammad Sher Khan
Army Aviation Base
Dhamial-Rawalpindi
West Pakistan

Danny's answer: The size of the carburetor venturi is such that at maximum engine rpm there will be an average air velocity (during the suction stroke) of about 300 feet per second through the carburetor venturi throat.

When the throttle is quickly decreased or closed, air passing through the carburetor is abruptly reduced. Since the engine has no fly wheel and is immediately disengaged at the clutch when quickly throttled back, there is insufficient engine inertia to cycle the engine through the intake strokes to suck even a small amount of air through the carburetor. This frequently results in complete air starvation to support combustion.

It is normally accepted practice to set the carburetor mixture adjustment slightly rich on aircraft used for autorotations.

TM 55-1520-225-10, page 7-7, paragraph 7-29, contains a warning as quoted below:

WARNING

"Pilots should bear in mind that engine stoppage is possible any time the throttle is closed rapidly, due to low engine inertia. Quick stops, autorotation flares and similar maneuvers should be practiced over areas where safe power-off landings can be made."

As an instructor pilot during training periods, it is necessary to practice autorotations over terrain which will allow a safe autorotational landing. During practice autorotations the throttle should be reduced enough to split the needles, then adjusted to 2300 engine rpm. The rotor rpm should be kept in the green arc by using the collective pitch. This method of operation provides the greatest margin of safety against possible engine stoppage.

Dear Danny: In our discussion of the dash 10 for the UH-1D, H helicopters we have found some conflicting statements regarding inlet guide vane actuator failure. In one paragraph a statement is made that the EGT will be low; in another paragraph a statement is made that the EGT will show an instantaneous rise. Please give a clarification of the two paragraphs.

DAC D.D.M.

Danny's answer: If the guide vanes fail in the closed position a maximum of 20 to 25 PSI of torque will be available. Although N1 may indicate normally, power application above 20 to 25 PSI will result in deterioration of N2 and rotor rpm while increasing N1. Placing the governor switch in the emergency position will not provide any increased power capability and increases the possibility of an N1 overspeed and an engine overtemperature.

If the inlet guide vanes fail in the open position during normal flight, it is likely that no indications will be evidenced. As power applications are made from increasingly low N1's acceleration times will correspondingly increase. Thanks for your query. A DA Form 2028 has been submitted for this statement to replace the paragraphs in the UH-1D, H, C and M dash 10s.

Hover Lift Computer

Major John M. Apgar

THE FOLLOWING two paragraphs were extracted from a U. S. ARMY AVIATION DIGEST article entitled "Pilot Error?":

"From January 1967 to March 1970, six accidents occurred in cargo helicopters due to overgross conditions. These accidents resulted in 62 fatalities, 99 injuries and a total damage cost of $2,784,645.

"Sometime in the future we may have an instrument in the cockpit that will display gross weight, payload capability and available power. Until that time, we must rely on the knowledge and judgment of the pilots. . . ."

The second quoted paragraph describes a necessary piece of equipment that would have prevented the appalling loss of life and money. The tense of that paragraph can now be changed to read: At present we *have* a development model of an instrument for the cockpit that *does* display gross weight, payload capability and available power. It is called a *hover lift computer* that will be able to be installed not only in a CH-47 but also in any helicopter. The cost of this equipment in production is estimated at $2,000, which is less than 1 percent of the cost of a UH-1 Huey.

Aviators know that the "good book" (the dash 10) tells them all there is to know about the safe operation of their birds; unfortunately, the human factor was and is there and will be until Robo the Computer takes over.

There is no way to give a man better judgment (as any Monday morning quarterback well knows), but we can give him more knowledge of his *immediate* situation to use his ability to judge. A hover lift computer installed in any helicopter can be used by the pilot of that aircraft to obtain the following:

- The dynamic weight of the aircraft, less fuel, as "seen" by the rotor.
- Information as to the aircraft's ability to take off safely from its location with a load of unknown weight.
- An optimized weight for the aircraft's cargo for available takeoff power.
- Information while in flight as to the ability of his aircraft, as loaded, to come to a hover at a specified location.
- Engine performance information to log for maintenance and safety purposes.
- An indication of pilot technique as well as an "abort meter."

The above functions of the hover lift computer are obtained for ambient conditions where the aircraft is located for in-ground effect or out-of-ground effect conditions. Parameters such as changing fuel loads, an extra tool box or a "hidden" case of C-rations are accounted for by the computer.

The computer shown in the picture has been test flown at Ft. Eustis, Va., and Ft. Monmouth, N.J., in a UH-1. Because it is a test model the computer is larger than the final model will be and information has to be entered by the pilot. Future models will be smaller in size (approximately 5-3/4 x 5-3/4 x 8") and all information entered into the computer will be done automatically by present "onboard" sensors; i.e., fuel weight, temperature, torque, altitude, barometer setting. The only requirement of the pilot will be to make a once-per-day engine performance check. For the rest of the day, regardless of location, he would read the lift margin from the meter and pass judgment. No charts, manuals, calculators or interpretation would be required.

The basic theory of the hover lift computer is to make a comparison of known parameters with those of unknown value and then present this to the pilot by means of a suitable display. To accomplish this two calculations must be stored in the computer; the first is maximum standard torque, and the second is effective dry weight. Thus, there are three distinct modes of operation (note function switch at lower right of picture) which are:

- Determination of maximum standard torque (TOP).
- Determination of effective dry weight (WEIGH).
- Indication of lift margin and effective gross weight (LIFT MARGIN).

The first two functions listed above are performed once per day (or at any other suitable interval); the third is performed as required (see chart).

Note in the picture the thumbwheels located between numbers on the eight dials. These thumb-

wheels are used to enter information (obtained from the cockpit instruments) into the computer. Future models will not have these dials because the information required will be entered directly into the computer from the present instrument sensors. The effective gross weight, effective dry weight and maximum standard torque are presented on a digital readout (top center meter on picture). Lift margin is continuously indicated in pounds on the meter in the center of the instrument. The picture indicates that the gross weight as "seen" by the rotor is 6,160 pounds—1,000 more pounds can be added to the aircraft before it would be unable to fly. This lift margin indicates the capability of the aircraft at the moment and location. It accounts for tall grass, rotor wash, temperature, engine performance, loads, etc. Because of this real-time, real-world operation it can also be used for an indication of pilot technique as well as an "abort meter."

Unfortunately, there is no qualitative materiel requirement (QMR) for this or any other instrument like it, which means no money will be available to produce it until there is a QMR. The estimated cost of a hover lift computer is $2,000 which is .8 percent of the cost of a quarter million dollar aircraft. This is equivalent to a $24 safety device on a $3,000 car.

Some of the benefits that would be derived from such a computer are:

- *Better utilization of assets.*
  - Maximum safe load for each flight.
  - Maximum emergency loading.
  - Mission planning.
  - Scale for weighing materiel.
- *Increased safety.*
  - Pilot has continuous information about his aircraft's capability.
  - Indication of engine degradation.
  - Detection of "hidden" weight.
  - Hover predictor (in-ground/out-of-ground effect).
  - "Abort takeoff" indicator.
- *Enhanced maintenance.*
  - Daily log of engine and rotor system performance.
  - Capability to develop a cost effective engine change program.
  - Training.
  - Check on "pilot technique."

Mr. aviator—
Mr. passenger—
Mr. commander—

This hover lift computer could be yours if the Army had a requirement for it.

Op procedures next page

Hover lift computer, complete with settings in the windows

OPERATING INSTRUCTIONS FOR HOVER LIFT COMPUTER

Operation #1—*Determination of Maximum Standard Torque Initial Conditions*

1. Turn unit on.
2. Function switch set to TOP.
3. IGE-OGE set to "OGE."

Steps	*Action*
1. Read altimeter setting on helicopter altimeter.	1. Enter this setting into BARO SET thumbwheel.
2. Fly aircraft at a convenient altitude above 500 feet.	2. Enter this altitude into ALTITUDE thumbwheel.
3. Read outside air temperature (OAT).	3. Enter OAT in OAT thumbwheel.
4. Perform engine topping procedure. Note OAT, max torque and altitude.	4. Enter appropriate info into ENTER TORQUE, OAT and ALTITUDE thumbwheels (may be done at pilot's leisure).
5. Read maximum standard torque on digital display.	5. Enter info into MAX STD TORQUE thumbwheel.

Operation #2—*Determination of Effective Dry Weight Initial Conditions*

1. Function switch set to WEIGH.

Steps	*Action*
1. Read altimeter setting on helicopter's altimeter.	1. Enter info into BARO SET.
2. Fly aircraft at a convenient altitude above 500 feet.	2. Enter this altitude into ALTITUDE.
3. Read OAT.	3. Enter info into OAT.
4. Read fuel weight on aircraft's indicator.	4. Enter info into FUEL WEIGHT.
5. Check PAYLOAD CHANGE thumbwheel.	5. Set thumbwheel to zero.
6. Hover aircraft. Note engine torque OAT, altitude and fuel weight.	6. Enter appropriate info ENTER TORQUE, OAT, ALTITUDE, and FUEL WEIGHT (may be done at pilot's leisure).
7. Read dry weight on digital display.	7. Enter info into EFF DRY WEIGHT thumbwheel.

Operation #3—*Determination of Hover Lift Margin and Effective Gross Weight Initial Conditions*

1. Function switch set to LIFT MARGIN.
2. IGE-OGE (in-ground/out-of-ground effect) switch set as desired.

Steps	*Action*
1. Read altimeter setting.	1. Enter info into BARO SET.
2. Determine altitude of pickup site.	2. Enter altitude into ALTITUDE.
3. Determine OAT at pickup site.	3. Enter OAT.
4. Read fuel weight.	4. Enter info into FUEL WEIGHT.
5. Read lift margin on center meter. Read effective gross weight on digital readout.	5. Make judgment (see NOTE 1).

NOTE: 1. Positive numbers on meter are how many pounds you can add to your load. Negative numbers are how many pounds you *must* take from your load.

2. All entries into future models of the computer will be obtained from the present aircraft instruments and entered automatically.

RECOVERY MISSION S.O.P.

Captain Jeffery Roy

"MAYDAY! MAYDAY . . . Exciter 598, engine failure, 3 miles north of Fire Support Base Bart."

Phu Rang radio monitored the transmission and replied, "Exciter 598, this is Phu Rang radio, understand your position is 3 miles north of Bart."

"Roger, we are going to land on an isolated highway.

"Roger 598, help is on the way, Phu Rang out."

This Mayday occurred in Southeast Asia and is repeated many times each week by aviation units flying in support of Free World Military Assistance Forces in the Republic of Vietnam. The following narration reflects how the recovery operation was handled.

Soon after the Mayday the phone rang at Exciter maintenance. "Exciter maintenance, Captain Youngblood speaking, sir."

"Sir, this is Sergeant Coons. We've just received a call from Phu Rang radio that 598 is down 3 miles north of Fire Support Base Bart on Highway 21. They report negative damage to the

aircraft which is secure and the crew is standing by."

"Thank you, SGT Coons. Did they say what happened to the aircraft?"

"Yes sir, the pilot reported an engine failure. I've notified the combat operations center (COC) and a CH-47 has been scheduled. You will be contacted on the company Fox Mike when it's inbound."

"All right," said Youngblood, "I'm on the way."

As Youngblood hung up his phone he instructed his platoon sergeant to gather a few men and some cargo straps for a recovery mission. In a matter of minutes they were on their way to the downed aircraft.

Later in the afternoon after the recovery CPT Youngblood's company commander asked about the status of 598. The captain replied that it might be up in 5 or 6 days.

"Five or 6 days?" the commander questioned. "I thought there was negative damage."

"Yes sir, there was no damage in the forced landing, but I had to send the aircraft to direct support (DS) for electrical work and a mast change. There was a new aircraft commander on board who didn't really know what to do. He heard that the radios should be removed so he had the crew chief cut them out. DS is estimating 150 manhours on the electrical work and 75 manhours for the mast change. I have the main rotor blades here, so we can take care of that problem when the aircraft comes back from maintenance."

"Hold on, Youngblood," exclaimed the commander, "what was wrong with the mast and main rotor blades?"

"We strapped the blades down too tight, sir, and forgot to put blocks between the main rotor head and the mast."

"O.K.," replied the CO, "keep me informed."

The following day Youngblood was visited by Major Smith, commander of the 406th Transportation Company, and his production control officer, Captain Knight. Youngblood escorted the men to the orderly room to meet with his commanding officer.

After the introduction the men sat down to a serious discussion about the assault helicopter company's maintenance and supply problems. MAJ Smith questioned Youngblood on his standard operating procedures (SOP) for recovering aircraft. Youngblood replied that he didn't have an SOP but his procedures were the same as the rest of the battalions.

MAJ Smith replied, "That's your problem then; let me give you some facts. First, in this area we do not have a recovery section in our battalion as they have down south in the Delta. Here we can only provide recovery to units to which we provide direct support. Those units are nondivisional units and those that are not part of the aviation brigade. So we have to rely on men at the unit level to rig their own aircraft.

"We have found through visiting other units that the majority of them do not have recovery SOP including duties of the crew of the downed aircraft, procedures for rigging the aircraft, safety precautions or duties of each member of the recovery crew.

"It has been recognized by your group commander and my battalion commander that unnecessary downtime and damage is being done to aircraft due to improper rigging. The biggest problem has been with the main rotor blades being tied down too tight.

"My group came up with a solution by using locally manufactured blade socks that fit over the tips of the blades and hook up to the aircraft very easily. So far they have worked very well. Our battalion headquarters has sent a request to Ft. Eustis, Va., for special textbooks on recovery of Army aircraft. These will be made available to our supported units.

"We'll soon have a team established to tour the area giving instruction to maintenance personnel on recovery procedures. The only thing that we will require from you will be an aircraft to use in the training exercise. A sample SOP is included in the special text. We suggest that you tailor it to your particular needs. Our people are always available to give you assistance in ordering supplies for your recovery team."

Everyone agreed that they did need training in recovery procedures. The men coordinated a date for the instruction to begin. Knight and Youngblood walked to the maintenance area and talked about building the recovery team and gathering up the necessary equipment. CPT Knight decided to have his recovery specialist contact Youngblood's platoon sergeant . . . together they could start preparing the recovery team for the instruction.

A few weeks after the Exciters had received their training a phone rang in the maintenance office. "Exciter maintenance," answers Youngblood. It was SGT Coons, the operations sergeant.

"CPT Youngblood, we just received a call from 704 . . . he is relaying a message for 046. He's down at a fire support base at coordinates XT 406209. The problem is FOD in the engine."

"O. K. sergeant, we're taking

off now to check it out."

"Yes sir," replied Coons, "I'll make all the arrangements with the COC."

"Sergeant Blake," called Youngblood, "get the recovery team out."

"Right away, sir!"

After the operation CPT Youngblood was sitting at his desk making out his report when the company commander came in. "Good evening sir."

"Howdy," said the CO "what's the status of 046?"

"I'm expecting it up tomorrow, sir; we're putting in our quick change assembly engine. In fact, we just about have the old engine out."

The commander asked if there was any other damage.

"No sir, the mission was a complete success!"

Edifice To Thinking: Pilot Judgment

In the field of aviation the authority exercised as pilot discretion is sometimes the critical and determining factor for satisfactory solutions to unnamed and even expectant questions

CW2 Jules F. Mier Jr.

"JAGUAR 65, this is Red Hawk 65," squawked the radio as it broke the silence within the operations building. The clock hanging slightly above the radio display indicated just minutes before midnight. A rhythmic pitter-patter of raindrops could be heard on the building's tin rooftop of the tactical operation center at Phuoc Vinh in the Republic of Vietnam.

"Red Hawk 65, Jaguar 65, send it," was the first reply within Jaguar operations.

As the two radio operators exchanged comments a descriptive picture began to unfold. The mission: a helicopter flight to Tay Ninh at 0030 hours to ferry three VIPs and their escorts with plans considered combat essential for the day's dawn operation.

The message was given to the duty officer and the wheels were set in motion to get the mission underway. After the selection of an aircraft, the crew chief and gunner were awakened and sent to the flight line to make ready their aircraft in the short time provided.

The pilots were awakened and informed of their expectant midnight flight in monsoon rain, scheduled to depart within 30 minutes.

The commanding officer also was awakened and informed of the mission. After acknowledgement of his question as to aircraft availability and pilots scheduled, his closing remarks to the duty officer were that he be awakened upon return of the aircraft or its being overdue.

Activity in the operations room perked up momentarily as the pilots received their initial briefing. The weather forecast, not surprisingly, was unfavorable. The second phase of the mission proceeded without incident as the aircraft and crew repositioned from their own flight line to the point of departure where the passengers were met and the final briefing received. Rain continued to fall in pestering drizzle. Visibility was reduced to the length of the runway, just over a half mile.

Here the flight was to begin with a crew of four and six passengers with classified documents through night rain some 50 miles over enemy jungle in a UH-1 to the tune of "combat essential."

Before the skids departed the ground the aircraft commander (AC) called Phuoc Vinh Metro and had his pilot copy all pertinent weather information. He then called Phuoc Vinh GCA and requested a radar vector toward Tay Ninh. The AC held a tactical instrument card but his 10 months' experience incountry and the fact that he was an aircraft commander gave him a certain but limited amount of confidence that he could handle the entire situation with sureness and poise. The pilot on the other hand had only 2 months incountry and, although a standard cardholder, lacked the self-confidence and assurance that such a task was routine and could proceed in a smooth, step by step manner.

"Phuoc Vinh GCA, Jaguar 437, we'll be making an ITO (instrument takeoff) and departing the ground to the south in 5 seconds."

"Jaguar 437, Phuoc Vinh GCA, roger."

The AC told his pilot to keep his eyes outfide the aircraft because he would be on the instruments. Pitch-pull, lift-off, the aircraft slowly made a vertical ascent and was completely in the soup at approximately 100 feet above the ground.

"Jaguar 437, GCA, radar contact, we have you climbing south over the southern perimeter; turn right heading 270 degrees for vector to Tay Ninh; Phuoc artillery reports negative artillery to the west of Phuoc Vinh. Say your present altitude and planned enroute altitude."

The aircraft controller and GCA controller exchanged comments over the radio and the flight was established enroute. The aircraft controller was flying by reference only to the aircraft instruments. That limited panel display of navigation aids, which sometimes seem exorbitant, was now worth its weight in gold. All instruments were functioning properly and the aircraft continued on a steady climb westward. It was apparent to all occupants of the aircraft that outside reference was physically impossible. After the aircraft reached 3,000 feet cruising altitude the AC relinquished the controls to his pilot.

"Jaguar 437, Phuoc Vinh GCA, we have negative aircraft traffic in your area but our radar shows a line of heavy precipitation across your planned flight path."

"GCA, 437, understand heavy precipitation. Can you vector me around it or at least through the lightest portions . . . ?"

"437, Phuoc Vinh . . . that's affirmative. Turn right heading 290 degrees. . . ."

The controller gave directions necessary for the aircraft to bypass the heavy precipitation areas to avoid possible severe turbulence and being "washed off" the radar scope. The AC, foreseeing the possibility of losing his radar assistance in the heart of the storm, turned his FM and VHF radios to Fire Support Base (FSB) Jamie and gave a call requesting radar assistance. From Phuoc Vinh GCAs reporting his position on UHF he was able to relay accurately to FSB Jamie GCA on his VHF and assured himself a position on two radar scopes. Within minutes upon penetration of the squall line the inevitable happened: Phuoc Vinh lost radar contact. It was evident to the two aviators that the GCA controller in a dreary, rain soaked tent at an isolated FSB now had more crucial responsibility than he would ever realize. Ten minutes of hectic turbulent flight passed.

"Tay Ninh GCA, Jaguar 437," squawked the UHF radio as the AC tuned ahead to get his aircraft established with his destination radar man. It was also necessary now to consider Black Virgin Mountain. One of the two protruding masses of earth in III Military Region, the Black Virgin, ascended to over 3,000 feet.

Nui Ba Den, the Vietnamese name for the mountain, has claimed an outlandish number of aircraft particularly rotorcraft in night and IFR conditions. The present projected flight path would have them pass directly through the mountain.

Climbing to a higher altitude would have boldly placed the aircraft in the thick of the thunderheads. It was necessary to be vectored clear of the protruding death trap with plenty of room for error, a task in which the Tay Ninh GCA controllers were well versed.

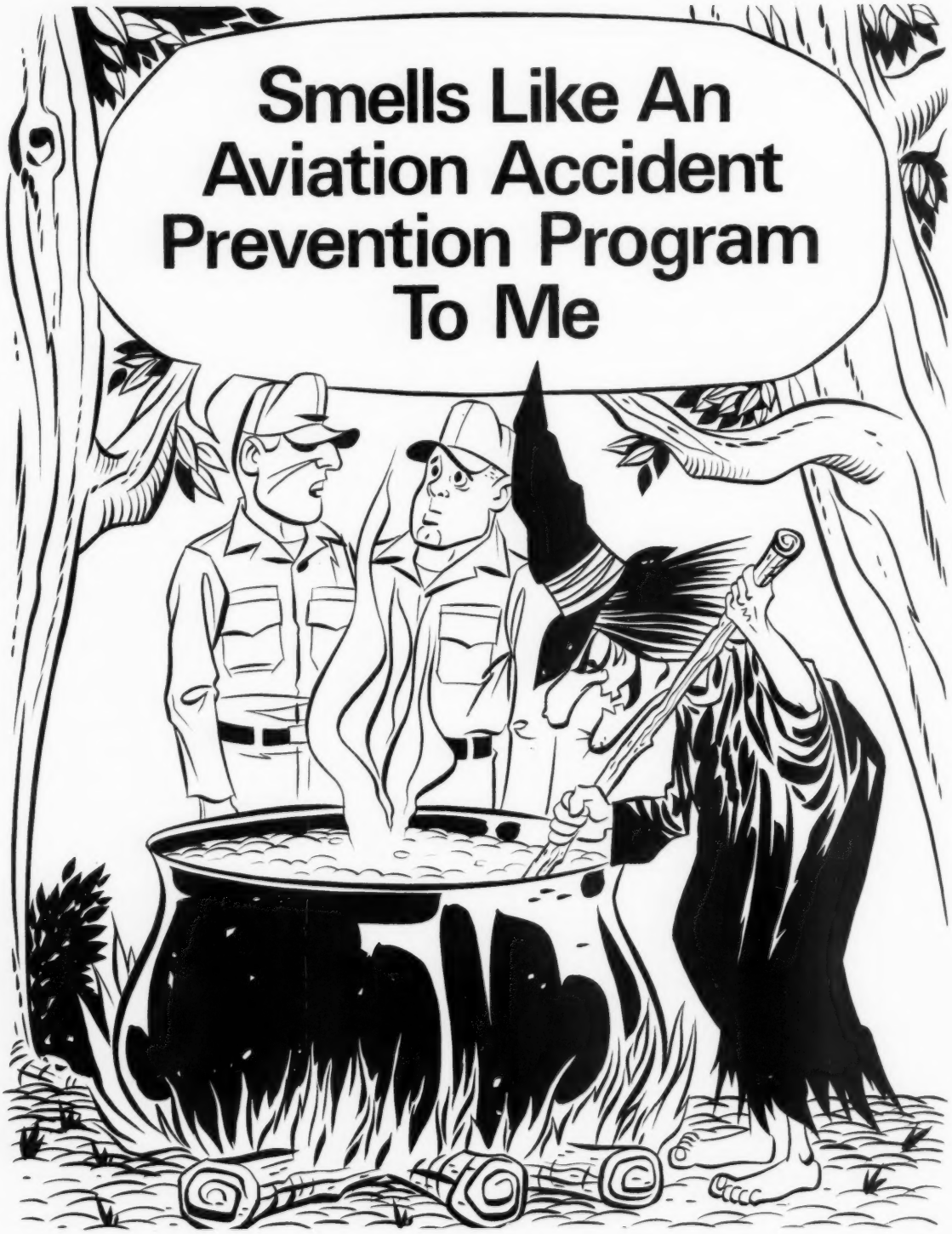
Sign off to FSB Jamie was terminated with a gratifying "thanks" by the pilot, and the remainder of the flight was basic instruments as the controller seemed to pull the aircraft by a string to a safe normal landing at Tay Ninh.

The first flight was over; the return flight was pending. The passengers disembarked the aircraft with a hardy "thank you" stating they would return in about 1 hour.

The pilots shut the aircraft down, each thinking silently to himself of the flight now behind them, doubting the severity of the mission essential aspect, pondering the possibilities of equipment malfunction and trying to draw enough courage to step out of their Huey and stand tall for a job well done.

Was the job well done? Was the mission really essential? Was equipment sufficient for the flight? Was the crew prepared? Were necessary or available safety precautions adhered to? Should the pilots have accepted the mission? Would you accept the mission? Would you make the return flight? These are questions without answers . . . questions that should be considered before *any* flight is attempted.

Pilot judgment is a basic characteristic that elevates and separates the mature and professional aviator from the throttle jockey. Has your pilot judgment been taxed recently? What about those around you? *Thinking* will cease only after life has ceased to exist. Inter-aviator communication should expand to infinite limits so that neither of the above will ever occur. We all fly in the same sky.


Smells Like An
Aviation Accident
Prevention Program
To Me

Major Roy P. Hooks
Education and Prevention Department
USABAAR

IT IS. But there's no black magic involved. The basic recipe is in AR 95-5. Everything except *dynamism*, the intangible quality which produces a vibrant program.

Using the Aviation Safety Planning Guide (Appendix VI, AR 95-5) and the 1971 Sample Aviation Accident Prevention Program, the unit aviation safety officer and/or council should be able to establish a comprehensive accident prevention program tailored to the unit's environmental and operational factors. How do you add *dynamism*? The number of ways is equal to your imagination and resourcefulness. Below are a few, listed by functional areas, which have been effective elsewhere and may assist you.

EDUCATION

Everyone connected with flying operations should be aware of the unit aviation safety program. They must realize that it is more than a monthly meeting, a safety board and an FOD jar. It's an integral part of maintenance, training, operational missions and all other aspects of operations. Three excellent means for promoting the program are:

Orientation. Commanders should devote a portion of their orientation for newly assigned personnel to the unit safety program. They should state the objectives of the program, command policies, and specify the role each individual has. They should solicit ideas, suggestions and criticisms. Orientations should be conducted for supported units. Liaison should be made with supported unit commanders and time should be requested to discuss aviation safety during their safety meetings, officer calls and command information periods. They should invite supported unit commanders and their staffs to attend command monthly safety meetings.

Publicity. Judicious use of publicity will help focus attention on the objectives of the safety program, the importance of active participation by all and the consequences of poor safety practices. Appropriately captioned posters and pictures of local situations create additional interest. I recall the interest created in one unit when pictures of corrosion, improper mounting bolts, frayed cables and working rivets detected on some unit aircraft which were being flown daily were displayed on the unit safety board. Aviation safety officers should coordinate with supported unit safety officers and display items on their safety boards.

Libraries. Attractive displays of *current* safety and other related publications located convenient to all aviation personnel will greatly assist in aviation accident prevention education.

TRAINING

Effective individual and unit training should eliminate the need for undue restrictive safety policies. However, adequate policies must be in effect to ensure safe training. In other words, safety policies and training programs must be carefully developed, based on local situations, so they support each other.

IP Selection. This is a very critical command function. Remember, these are the folks who are in position to greatly influence other aviators. You must be able to depend on them to fully integrate flight safety into the standardization program. How do you select them? AR 95-5 states that standardization and ability to instruct should govern IP selection, rather than total flying time, rank or aviation rating. But none of these are sufficient without *maturity* and *desire*. The standardization board should carefully evaluate prospective IPs. Members of the board should interview each prospect's immediate supervisor, operations officer, maintenance officer, instructor pilots who have flown with him and, of course, the prospect. The commander should make his selection based on the standardization board's recommendations.

Standardization. Standardization training must be continuous, with provisions for periodic standardization checkrides. Standardization of newly assigned aviators should begin with evaluation of past training, experience and current proficiency. Training must continue until newly assigned aviators meet required standards. Training and periodic standardization checkrides must be tailored to the mission and equipment and geared to the needs of the individual. This is accomplished by evaluating his job assignment and devoting maximum training time to the critical aspects of the type flying he will be expected to do. This does not mean that other areas are ignored. Rather, it is a matter of emphasis. Finally, if conditions permit, it is advantageous to limit aviators to

flight in a single type and model aircraft.

Safety Meetings. We often fail to capitalize on this period of training because of dull, unprofessional presentations. Add new zest to your safety meetings by programming participation by unit members and those from subordinate units. Assign topics and time frames to individuals or units on a rotational basis. Big dividends are in store for those who follow this advice. Not only do members of a unit enjoy listening to each other, but keen competition for the best presentations will rapidly develop. This can be expedited by quarterly awards for the most appropriate, provocative and professional presentations. Reserve a portion of each meeting for an open forum with the commander. This provides him an excellent opportunity to discuss safety and standardization policies and problems. Equally important, the aviators appreciate having a regular opportunity to discuss, in an informal atmosphere, safety and standardization problems with their commander.

OPERATIONS

Let's get some extra mileage out of those morning briefings. Have a short dash 10 presentation by an individual every morning on each type aircraft assigned. The operations officer should assign topics to ensure systematic and appropriate dash 10 coverage. Have a daily safety cue. It does not have to be a rhyme or riddle and it may well be a personal experience. It's important to not assign responsibilities for presenting safety cues. Encourage participation by soliciting cues from the group. I recently served in a unit where this technique produced an average of two or three contributions daily. Many were simply discussions of poor safety practices observed in our unit, which we were able to correct immediately.

Mission Scheduling. Continous orientation of commanders of supported units and their staffs on the flying hour program and the capabilities and limitations of the unit will contribute to the proper use of aviation resources and ensure receipt of adequate information for mission planning.

Mission Planning. Mission sheets can be used for control purposes as well as to provide valuable statistical data. Be sure to make safety a required subtopic under the coordinating instructions of your operations orders. Include such items as hazards along proposed flight routes. A very effective procedure during unit training is to have platoon commanders, flight leaders, etc., present their operations orders for approval before issuing them to their aviators. This is particularly valuable in units with low levels of experience.

MAINTENANCE

An accurate indication of the quality of maintenance that is being performed is the appearance of shop and maintenance areas. Clean, carefully policed and well organized maintenance areas are conducive to good morale and high quality maintenance.

Training. Continuous on-the-job training (OJT) is indispensable to an effective maintenance program. While it may hurt momentarily, formal on-the-job training is best for intermediate and long-range time frames. Try two 1-hour periods per week, with 50 percent of personnel at each class, and one makeup period. With this program, you can expand and reinforce the knowledge gained from formal schooling; keep abreast of changes in requirements, procedures and techniques; and continuously emphasize safety and quality control. Initially, you may have to force this program, but it *will* pay dividends. I guarantee it.

Supervision. Frontline supervision continues to be a problem, primarily because of the nonavailability of qualified personnel. This has long been a problem and it is not likely that VOLAR will correct it. Faced with this situation, what do you do? One way to gain excellent frontline supervision, without objections associated with the term *supervision*, is to require your aviators to assist—not closely supervise, but assist—crew chiefs in performing daily inspections. It will boost the morale of crew chiefs, broaden the knowledge of aviators and crew chiefs and promote greater mutual respect and confidence between them, in addition to promoting other favorable results.

Accident prevention is a command responsibility that must be integrated into all functional areas involving the use, operation and maintenance of aircraft. Safety directives must provide adequate instructions and safeguards for the protection of personnel and equipment, without reducing unit effectiveness.

This discussion has not been all-encompassing, nor is it anticipated you will agree with all suggestions offered. However, as long as there is no single panacea for aviation accident prevention, we must strive to make our safety program dynamic so our other programs can be responsive to it. As a cornerstone for such a program, I commend to you the Eleven Steps to Effective Aircraft Accident Prevention, outlined in Appendix VII, AR 95-5.

USUAL APPROACH

UH-1H with flattened skids and no tail rotor rests on pinnacle landing area after steep downhill approach and flare resulted in barbed wire entanglement

A UH-1H CREW was on a routine support mission. The AC had flown the same mission many times and was very familiar with the pinnacle landing area. He received clearance to land, but he did not receive or ask for the wind direction and velocity. The pilot was flying during their first approach. Just before short final, the AC took control, telling the pilot his approach was too slow.

The AC made a 360-degree turn to the right and positioned the helicopter for another approach. Realizing his closure speed was too fast, he flared, allowing the tail rotor to dip into a 2- to 3-foot high line of rolled barbed wire. One strand of the wire lodged in the tail rotor blades, causing the other end of the wire to whip through the air and around the main tubular steel support inside the synchronized elevator control surface. The tail rotor blades and 90-degree gearbox were torn loose, causing the tail to swing left in an upslope direction. The tail stinger hit the ground hard, bending upward and to the right. The AC lowered collective and applied hard left cyclic, trying to remain on the pinnacle. The nose swung left and the UH-1 landed hard while drifting to the right.

Analysis: ". . . The crew did not perform a high and low reconnaissance, as prescribed for pinnacle landings. The AC's approach was fast and steep, requiring a hard deceleration on short final and causing the helicopter to be in an extremely tail low attitude when it struck the wire.

"The AC elected to land downhill with no reason for selecting that approach route. He failed to ask for wind direction and velocity before selecting the approach route. He did not ask for smoke to be displayed in the landing area and he did not take time to consider the wind when the pilot's approach did not turn out as he desired. Instead, the AC made a 360-degree turn and reestablished the approach along the same route. He realized things were not quite right on short final but, rather than make a go-around to determine the cause of his problem, he decided he could safely reach the pad. . . ."

Flight surgeon: "This accident is an example of the head-up-and-locked syndrome. The fact that the *usual* winds were from one direction and the *usual* approach was the one used by the AC is no excuse. In aviation, the unexpected must always be the expected and basic safety dictates that all factors be evaluated each time they are present. To do otherwise, as in this case, is to invite disaster."

The board recommended that all pilots review the approach and landing procedures outlined in chapter 3, paragraphs 3-56 through 3-60, of the UH-1H dash 10. It stressed the need for both high and low reconnaissances and stated that very familiar landing areas can become dangerous through the addition of obstacles or wind changes.

marginal weather equation

SFC Jerry E. Mills
Aircraft Accident Analysis & Investigation Dept.
USABAAR

A STANDARD college dictionary defines the following terms:

Poor: Lacking in abundance or good qualities; scanty; meager.

Error: Something done, said or believed incorrectly. A mistake. The condition of deviating from what is correct or true in judgment, belief or action.

Marginal: Having relatively low quality or value; meager; minimal.

Low: Having small elevation; extending upward relatively little [such as marginal weather visibility].

Fatigue: The condition of being very tired as a result of physical or mental exertion; weariness; exhaustion.

Vertigo: Any of a group of disorders in which a person feels as if he or his surroundings are whirling around; dizziness.

Any equation must be balanced to form a correct answer or course of action. If the above terms are included as factors for aviation courses of action, our solutions are often incorrect and sometimes catastrophic. In aviation, there can be no incorrect answers if people and equipment are to survive. Any combination of the above terms and the actions they represent can and will cause marginal weather accidents.

With this in mind, let's review two strike accidents which resulted in two fatalities and four injuries. The causes were attributed to marginal weather and *other factors.* Both occurred in the same weather conditions and the same general area of operations. Both involved darkness, fog, drizzle and ceilings of 700 feet or lower.

A flight of two Cobras was returning to home base after completing a day of combat missions. The pilots had to request GCA assistance to an Army airfield because the weather had deteriorated. After completing the GCA, they refueled and elected to continue the flight to their home base. The lead helicopter was flying low level over a highway when the wing helicopter pilot radioed he was returning to the airfield they had just left. The lead pilot replied that he was doing the same. After the wing Cobra returned to the airfield and landed, the pilot and the control tower operator tried to contact the lead Cobra. It was found the next morning and investigation revealed it impacted at a high rate of speed. Both occupants were killed.

Before we make any conclusions, what are possible and probable cause factors for this accident—Weather? Engine/component malfunction/failure? Instrument malfunction/failure? Crew errors?

Both Cobra pilots had been awake for 15 hours and on continuous duty for 13 hours before the accident. Both had flown 8-1/2 hours, the majority of which was flown in a combat environment. One pilot had 11 months and 344 flying hours of combat experience. The other had 4 months and 141 flying hours of combat experience. Between them, they had 42 hours of night flying and 1 hour of weather instruments in the Cobra. Both pilots were known to be very obstinate at times and take excessive pride in accomplishing any assigned missions, regardless of environment. The pilot who was killed was operations officer of his unit. It was reported that he became upset with other aviators in the unit, at times, when they refused to fly because of weather or maintenance problems.

There were no major writeups on the destroyed Cobra and, as far as could be determined, all systems were operational at the time of the crash.

MARGINAL WEATHER

With this information, what do you think were the cause factors? From our list of possible or probable factors, two remain—weather and crew errors. The true cause factors were crew errors in the decision to return to home base in marginal weather at night, thus extending the flight beyond their capabilities, and failure to comply with established procedures for marginal weather operations. Related factors were restricted visibility due to darkness, low clouds and fog, and training. Although the pilot who was killed had a current rotary wing tactical instrument ticket, he had received only 1 hour of supervised training during the previous 6 months. The other pilot had an expired instrument ticket and had received no supervised training for more than a year.

A UH-1H was on a night flight with a crew of four. The first mission had been flown without mishap, but was curtailed because of bad weather. The second mission was cancelled because of the weather. The third and last mission was undertaken to locate a ground unit which was out of contact with its parent unit. After liftoff, the pilot established flight following with GCA. At approximately 700 feet, the helicopter entered IMC. At this point the pilot became disoriented because of vertigo and the copilot had to take control. He climbed to 2,700 feet where the pilot again took control and noted a loss of engine rpm. The helicopter began spinning left out of control and the pilot and copilot switched controls back and forth between them in unsuccessful attempts to recover control. The helicopter crashed inverted. One crew member stated it looked as if the trees were coming down at them. Although injured, the four crew members, including the copilot who was pinned under the collapsed ceiling, survived.

What conclusions can be made about this accident? Basically, they can be listed as those which resulted in the Cobra crash.

The UH-1H pilot had been awake for 10 hours, of which 7 hours were continuous duty, including 5 hours of flying before the accident. He had 1,088 flying hours in UH-1Hs, of which 48 hours were at night and 16 hours were under the hood. He had a current rotary wing tactical instrument ticket.

The copilot had experienced 18 hours of continuous duty prior to the accident. He had flown for 6 hours prior to the last mission and had a current rotary wing tactical instrument ticket, but only 2 hours of hooded flight and no night flying during his 41 hours of UH-1H time.

Cause factors were failure to successfully control the helicopter after inadvertently flying into instrument meteorological conditions and prolonged flight duties beyond safe limits of physical and mental endurance.

Note the similarity of these two accidents and their cause factors—*marginal weather at night and extended flight beyond crew capabilities.* Nonrelated factors involved in the UH-1H accident included two injuries which could probably have been prevented by the use of restraining devices and a properly fitted helmet. One crewman was injured because he was not strapped in when the helicopter became inverted and he fell to the ceiling, causing his injury. Another crewman was wearing an improperly fitted helmet which he shared with other flight personnel. At impact, his helmet was lost because it had no chin strap and fitted him loosely.

Recommendations resulting from the investigation of these two accidents included:

Emphasis to aviators about the subtle dangers and severe consequences which result from fatigue.

Emphasis about the dangers of IMC flying when either aircraft or aviators are not properly equipped to accomplish IMC flying.

Continued practice, with or without hoods, in VFR conditions to maintain proficiency.

The need for pilots to be continually educated about the problems of vertigo. They must be taught to believe their instruments and not their physical sensations and instincts.

Emphasis on the hazards of intermittent IMC flight to impress aviators with the time periods necessary to adjust between VFR and IMC flying. At least one pilot should follow IMC procedures during periods of marginal visibility.

Pilots should not fly during a full day and be expected to perform adequately during the succeeding night.

Emphasis on the full use of restraints, particularly when there are obvious operational difficulties.

Individually fitted and complete helmets to provide maximum protection and retention.

While these recommendations may not be the final solution to marginal weather equations, they should be given serious consideration as guidelines for all prevention programs.

We can give a much better solution to this equation by substituting some better words than those listed at the beginning of this article—*good* for *poor, accuracy* for *error, adequate* for *marginal, high* for *low* and *physically* and *mentally fit* for *fatigue.*

IS YOUR SHOP SAFE?

Clarence J. Carter
Aircraft Accident Analysis and Investigation Dept., USABAAR

DO YOU CHANGE the bit in your electric drill while the cord is plugged in? Have you tried to hold the chuck of your drill while depressing the switch? Try it and determine how much power it has. This will show you what will happen if you insist on changing the bit while the drill is connected to an electrical source. Someday, your hand is going to slip and you'll have fingers, chuck key, bit and electrical cord all wound up in a tight wad at the end of your drill.

This is only one of the ever-present dangers that go along with electric handtools. Probably, one of the most violated basic safety requirements for all electrical equipment is proper grounding. This is the one you never know about until it is too late. It is the one you find out about when you start to drill a hole in something outside the shop and touch your knee to the ground while the drill is running. If it is not properly gounded, you will find you can't let go of the drill and it won't let go of you!

If you're really interested in proper shop safety, both at home and on the job, you will insist that the gound wires on your electric handtools are in good shape. Most electric handtools made in the United States today have a three-wire, 110-volt system. The green wire is the gound. Most houses and shops are equipped with three-prong wall plugs. Two of the prongs are flat and one is round. The round prong is the ground. Some older homes and shops are only equipped with two-slot, 110-volt wall receptacles. Adapters offer a means of making these receptacles safe for use with electric handtools. But most people use adapters in the wrong manner.

An adapter is a small device designed to receive three-prong plugs on one end and plug into two-prong wall receptacles on the other. Its major identifying feature is a green wire extending from it. This wire has a hook type connector designed to fit the screw located in the center of wall receptacles. This screw is used to retain the receptacle cover, but it is also threaded into the wall receptacle metal mounting box. All mounting boxes are equipped with a screw for attaching grounding wires. If it is grounded, your problems are solved.

Adapters are inexpensive and most electric handtools come equipped with them. Unfortunately, many people use them without hooking up the gound wires. This is not the answer. The best way, if you have two-slot wall receptacles, is to place the adapter in the receptacle, hook up the ground wire to the cover mounting screw and leave it there. To properly ground wall receptacles, attach one end of a No. 10 or larger wire to the mounting box and the other end to a water pipe or metal rod that is buried at least 3 feet in the ground. Do not use a hot water pipe. These are sometimes insulated by the hot water heaters.

The problems discussed here are representative of all tools powered by electricity, whether handheld or bench-mounted. If you ensure that those little green wires are hooked to good safe gounds, you will have a safe shop. Remember, if you use an extension cord, it must also have that third wire to ensure that you won't receive a nasty, possibly fatal electrical shock.

A great number of deaths are caused each year because people insist on using power tools with ungrounded or two-wire extension cords. Some of the better known electrical handtool companies are producing plastic- or nylon-incased drills, saws, etc. This is a decided improvement over all-metal tools. But you must remember that *chucks* and *bits* are still made of metal. If you don't unplug your drill when you change the bit, you can slip and have a hand that looks like fresh ground round.

The most important things to remember about an electrical shop or handtools are to read and heed the handbook and to be sure the tool is always in good repair.

AVIATION ACCIDENT PREVENTION FORUM

an interchange of ideas between readers and USABAAR on subjects of aviation accident prevention

EMERGENCY ESCAPE SYSTEMS

Having read the letter from Gene R. Drew, U.S. Naval Aerospace Recovery Facility, and CW4 Johnson's excellent article, "Emergency Escape Systems in Helicopters," in the August AVIATION DIGEST, some of my colleagues and I are interested in hearing more on emergency escape systems. Why are they all but forgotten in our modern helicopter fleet? If statistics and research show 45 percent of the inflight helicopter fatalities could have been prevented with inflight escape systems, why has there not been more development in this area? Certainly, a 45-percent reduction in helicopter accident fatalities would be a giant step for aviation safety.

Technical risks exist in most phases of aviation, but a technologically oriented, industrial nation that puts men on the moon (and shows them there live for home television viewers) can develop a system that will allow a crew to exit an uncontrollable helicopter.

At the least, seats in existing systems should be designed to accommodate parachutes as a minimum crew escape system.

In any event, as a young aviator looking forward to a long aviation career, surviving catastrophic inflight helicopter mishaps is of major interest to me, and I strongly support the immediate development and incorporation of these systems for emergency escape.—1LT, aviator

Since your letter was written, an outstanding article on helicopter emergency escape systems and problems involved in incorporating these systems into present and future helicopters has appeared in the September issue of the AVIATION DIGEST. Entitled "The Helicopter: Hazardous at Any Height?" and written by Lieutenant W. H. Baker, US Navy, this article should go a long way toward answering your basic questions and furnishing insight into the research and development program set up to develop a practical means of inflight escape from helicopters. This program is under the supervision of the Naval Weapons Laboratory.

From the standpoint of crew and passenger survivability, USABAAR has recognized for some time the requirement for an inflight escape system for Army helicopters. There are many approaches to such a system. Some presented by industry certainly show promise. Unfortunately, the system has received an undeserved low priority for development.

The success of any future program depends on the interest and understanding of the necessity for these systems which you and your colleagues show. We thank you for expressing your views, and we shall continue to pass on to the aviators in the field articles of interest on helicopter escape systems. We will appreciate any comments you may have on these articles as they appear.

Readers are invited to participate in this forum. Send your ideas, comments and recommendations to USABAAR, Fort Rucker, Alabama 36360

EIRs

In a recent FORUM column, you urged your readers to submit EIRs promptly. My question is, since different agencies are responsible for various pieces of life support equipment, where are the EIRs sent?—CWO, ASO

According to the Aviation Life Support Newsletter, March 1971, EIRs for life support equipment in the Federal Stock Classes listed may be sent to the addresses indicated. When in doubt, send the EIR to the AMC Project Office, Aviation Life Support Equipment, ATTN: AMCPO-LSE, P. O. Box 209, St. Louis, Missouri 63166, and they will see that it gets prompt attention.

NOTE: TM 38-750, which outlines submission of EIRs, should be consulted for items of life support equipment in FSCs not listed.

FSC	ADDRESS
1365 - 1380	Edgewood Arsenal ATTN: SMUEA-TSE-TPL Edgewood, Maryland 21010
1660 1680	U.S. Army Aviation Systems Command ATTN: AMSAV-R-MEI P.O. Box 209, Main Office St. Louis, Missouri 63166
1670	U.S. Army Aviation Systems Command ATTN: AMSAV-L-F P.O. Box 209, Main Office St. Louis, Missouri 63166
3110 - 3130 5305 - 5365	Frankford Arsenal U.S. Army Class Managing Activity ATTN: SMUFA-R2100 Philadelphia, Pennsylvania 19137
6505 - 6545 (Medical)	The Surgeon General ATTN: Chief Maintenance Division Department of the Army Washington, D. C. 20315
6630 - 6640 6810 - 6850 9110 - 9160	U.S. Army Petroleum Center ATTN: AMXPC-LS Cameron Station Alexandria, Virginia 22314
3510 - 5210 7105 - 8540 9310 - 9999	U.S. Army Mobility Equipment Command ATTN: AMSME-MAO St. Louis, Missouri 63120
8905 - 8975	See AR 31-200 w/change 1 (para. 5-25 through 5-30)
5820	Commanding General U.S. Army Electronics Command Fort Monmouth, New Jersey 07703

A polished instructor pilot would probably have had difficulty making an autorotation under the circumstances

Failure on Failure on...

AN OH-6A PILOT, with one passenger aboard, took off to the west, then turned east on a command and control mission, remaining at an estimated altitude of 200 feet. Altitude and air speed could only be estimated because the altimeter and air speed indicator were inoperative. These instruments had been written up after the first flight of the day.

The pilot had been told to stay away from the mountains because of enemy activity and artillery which was firing at the mountains. After passing the southern portion of the mountain, he turned north, adjusted his power to climb and started a right turn. Before he rolled out of the turn, he experienced a loss of power which he did not immediately recognize and the nose dropped.

The pilot noticed that his needles had split. His rotor rpm was slightly above 400 and dropping. He bottomed collective, but due to the nose down right turn attitude, his rotor rpm would not build and continued to drop to an estimated 300 rpm. Just prior to ground impact, the pilot tried to level the helicopter and bring the nose up. Because of the low rotor rpm, he could not level it or flare. The right skid hit the ground and was torn off. The OH-6 flipped over forward, bounced and skidded to a stop on its right side. The pilot sustained a major back injury and the passenger had a minor foot injury. The helicopter was destroyed.

Weather in the area was excellent. Although only about 200 feet above the ground when his trouble started, the pilot had a good forced landing area below. His air speed was high enough to have performed a successful autorotation. A prime factor in this accident was the pilot's lack of experience (33 OH-6A flying hours) and slow reaction time. The fact that he maintained a right turn all the way down made it more difficult to recover lost rpm. He said he didn't enter autorotation until the rpm had bled to just about 400 and it continued to deteriorate to about 300 rpm. At that time, he had no further cyclic or collective response.

The pilot should not have attempted the flight with inoperative altimeter and air speed indicators. A polished instructor pilot would probably have had difficulty making an autorotation under the circumstances.

The passenger said he thought the engine was still running after the crash. Mud found in the compressor section indicated this was the case. While there was no mud in the plane of rotation of the compressor blades, the stator vanes on both sides of the compressor blades were caked with dirt. Since the rotor rpm dropped while the engine was running, a short shaft failure was suspected. Examination of the short shaft and associated couplings showed a failure had occurred in this area. It was determined that the most probable point of failure was in the lower Bendix coupling. The coupling had been sheared and there were rust marks on the fracture.

The helicopter had recently undergone an engine change. A new crew performed the change and the supervisor was not present. All bolts were removed from the engine mounts, but the short shaft coupling was not disconnected and the weight of the engine rested on this coupling. When the crew could not get the engine out, they called an engine tech rep for advice. He recognized the problem, took corrective action and advised the maintenance crew that the short shaft required changing because the weight of the engine had been allowed to rest on the coupling. This change was never accomplished and, at the time of the crash, the same short shaft was installed.

Tech rep: "I recommended replacement of the P/N 369A5510 shaft assembly . . . due to the fact that, during engine removal, the short shaft connecting bolts had not been disconnected and the full weight of the engine had been allowed to be suspended from the lower Bendix coupling of the shaft assembly. I was told the team leader would be informed and the shaft replaced . . ."

Findings: Short shaft failure due to the previously weakened Bendix coupling.

Failure to provide proper supervision when the engine was removed and failure to replace the short shaft.

The pilot failed to recognize he had a short shaft failure and entered autorotation too late.

The pilot was operating without altimeter and air speed indicators.

Recommendations: Aviators be briefed on emergency procedures for short shaft failure.

Maintenance officers be notified of this accident so they can assure proper supervision during engine changes.

NIGHT FORMATION TAKEOFF

COLLISION

FOUR OH-6As and three AH-1Gs took off and climbed to approximately 300 feet at an air speed of about 65 knots on a night mission. The number one OH-6 made a steep right bank while number two began a shallow right turn, and the two helicopters collided. Sparks were seen by the pilots of the two OH-6s immediately behind the colliding helicopters and they broke left to avoid the collision. The colliding helicopters crashed and burned in a muddy rice paddy approximately one-quarter mile from the airfield. All four crew members aboard were killed at impact.

Board analysis: ". . . From the position of the wreckage and statements from witnesses, the OH-6s apparently struck and remained together until ground impact. Pilots of the number three and four helicopters stated that the number one pilot had an operational rotating beacon but, after takeoff, the beacon either became inoperative or was turned off. Also, the number two pilot had gotten off slowly and was accelerating to catch up. Although the navigation lights on number one were on, the fact that the rotating beacon was not on for a short period prior to the midair collision probably reduced the ability of the number two pilot to maintain visual contact with number one. . . ."

Findings: "Established: The number two helicopter flew into the number one helicopter. Visibility was limited due to darkness.

"Probable or suspected: The number one pilot executed an abrupt turn without first notifying his flight. Intentionally or inadvertently, he turned off his rotating beacon, lessening the number two pilot's ability to see the lead helicopter.

"Nonrelated: The number two OH-6 was flying on a circled red X for an inoperative landing light. The tail rotor bellcrank had been replaced and the helicopter had not been test flown."

Indorsement: "Concur with the findings of the board, with the following amendments:

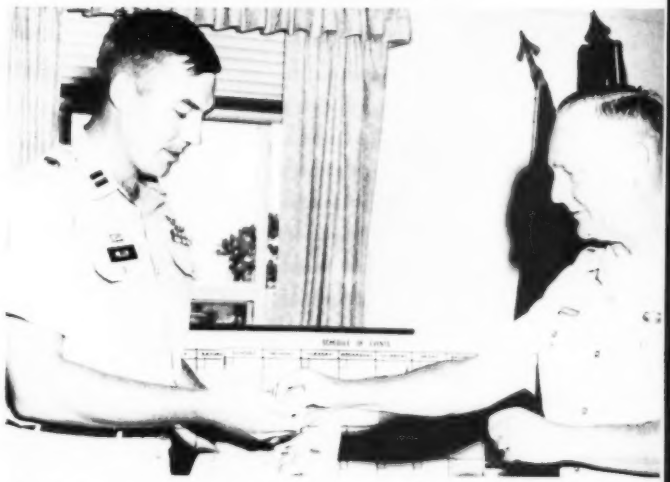
"The board failed to address supervisory influences on this accident. There was no indication that daylight departure procedures were in any way modified for the night departure. There was no indication that a pretakeoff briefing was conducted by the mission commander. No account is taken of the fact that the pilot of the number two helicopter had but 2.3 hours of night first pilot experience.

"Established cause factors should also include: The unit commander failed to properly supervise the operations of his unit by allowing a night formation departure when it was in no way necessary to the mission. The unit commander failed to ensure that proper pretakeoff briefings were conducted and failed to ensure adequate training of air crews for the mission.

"Following the accident, all units were directed that night formation takeoffs are prohibited and that air mission commanders will conduct pretakeoff briefings for all formation flights."

BROKEN WING AWARDS

FORT WOLTERS, TEXAS—CW2 Charles J. Ray, center, IP at Dempsey Army Heliport, was presented the Army aviation Broken Wing Award by Brigadier General Robert N. Mackinnon, commandant of the Army Primary Helicopter School, as his wife Judith looks on. A student pilot was at the controls when the nose of the TH-55A yawed sharply to the right. CW2 Ray took control, increased engine rpm to 2900 and lowered collective slightly to initiate a precautionary landing to a field immediately to his front. During the first 3 to 4 seconds, the helicopter responded to control inputs, but it picked up a high frequency vibration and grinding noise from the rear. The nose yawed about 40 degrees to the right, with left pedal correction having no effect. CW2 Ray lowered collective full down with the needles joined and reduced the rpm to 2650. Reduction of rpm caused the nose to turn to the left, stabilizing at a 15-degree right crab, while maintaining a straight ground track. At 75 feet, CW2 Ray closed the throttle and autorotated, at which time the nose straightened. The TH-55 yawed 40 degrees to the right when it was placed in a deceleration attitude. Application of initial and cushioning pitch brought the nose to the left. Final cushioning pitch straightened the helicopter just as it touched down. Analysis revealed the saddle block failed at the point where the left tail boom support strut is attached to it. This allowed the tail boom to shift, causing the tail rotor driveshaft to make contact with the forward attachment fitting. This caused the tail rotor driveshaft to sever.



FORT STILL, OKLAHOMA—Captain Ronald L. Miller, 21st Aviation Battalion, was presented the Army aviation Broken Wing Award by Major General Roderick Wetherill, post commander. CPT Miller and his passenger were on a cross-country training flight in a T-41B. A quick-spreading fire caused by a broken fuel connector stopped the engine. CPT Miller glided earthward as flames leapt from the engine. He landed on a dirt road not quite 20 feet wide, with close fences on both sides. As the airplane rolled to a stop, the engine fire spread into the cockpit. CPT Miller and his passenger escaped with no injuries. The T-41 was destroyed by fire.

TOO TIGHT, TOO FAST!

UH-1 AC: "I was flying number seven in trail formation, approaching an airfield at approximately 70 to 75 knots. On final, the flight began a rather heavy flare and it appeared I was going to hit the helicopter to my front. I slid to the right and the formation executed another heavy flare. I flared with them and kept sliding to the right. At this point, our helicopter began to shake and the tail started to turn left. I leveled the skids so the tail boom would not strike anything above the ground.

"As we came almost parallel to the runway, the aircraft was still shaking and the tail continued swinging to the left. I applied left pedal and there was no reaction. Thinking I had tail rotor failure, I rolled off throttle to keep the tail from hitting the helicopter in front. At this time, the tail swung back 90 degrees and the helicopter settled to the ground. The blades were dipping down to the left and I tried to grab the pilot so he would not exit on the left side. Looking back, I saw fire coming from the fuel cell.

"The pilot got out from the left side and I unbuckled myself and tried to open my door and chicken plate. I drew back the chicken plate, but could not open the door. I crawled over the console and got out through the right cargo door. When I went around to the other side, I saw the pilot had been struck by a main rotor blade."

Analysis: "At impact, the left skid collapsed and the tail boom was severed. The helicopter landed upright and fire started in the aft section of the fuselage seconds later. There was no firefighting equipment available at the airfield and the UH-1 was destroyed. The cause of the fire was undetermined. A battery fire the previous day was suspected to have been caused by a faulty voltage regulator.

"The unit involved was in the habit of making fast approaches while maintaining a 1 to 1½ rotor disc separation between helicopters. This type of approach was unnecessary in this case. The stagefield was large enough to accommodate the eight UH-1s using the standard 2 to 2½ rotor disc separation. It was also established that the flight was forming up at the time of the initial flare by the lead helicopter and the trailing helicopters did not have proper separation. The fast air speed (70 to 75 knots) on final and the inadequate separation reduced the time trailing aviators had to react.

"The extreme tail low deceleration used to avoid collision and subsequent leveling induced mast bumping. The AC failed to recognize this and did not take proper corrective action. When he slid to the right, vortices from preceding helicopters were encountered, resulting in an area of severe turbulence. This greatly reduced the effectiveness of antitorque control. When the AC could not stop the tail from turning left, he incorrectly analyzed his situation as tail rotor failure.

"Rolling off throttle at a 25- to 50-foot hover resulted in complete loss of power and a severe loss of rpm. Neither the AC nor the pilot considered making a go-around when it became apparent their situation had deteriorated to the extent of being beyond their capabilities and aircraft limitations."

Flight surgeon: "All members of the crew successfully exited. However, the pilot was struck on the left hip by a main rotor blade. He was evacuated to the nearest hospital and died as emergency surgery was started. He was found to have a sizeable laceration of the liver and the cause of death was hemorrhage, leading to irreversible shock.

"Continuing emphasis should be placed on making crew members and passengers acutely aware of the presence and location of rotor blades when exiting rotary wing aircraft.

"The AC had flown 10 hours the day before the accident and it is remotely possible this may have contributed to the accident. However, he denied having any symptoms of fatigue."

Findings: "The AC reduced throttle to flight idle while operating outside the flight envelope (25

to 50 feet agl at zero air speed), as outlined in the dash 10.

"Both the AC and pilot failed to initiate a go-around when it was apparent their helicopter was overtaking the helicopter to their front.

"Neither the AC nor pilot identified mast bumping.

"Both aviators failed to maintain the standard 2 to 2½ rotor disc separation between aircraft.

"The AC had flown more than 10 hours during the 24 hours prior to the accident. This was not in accordance with the SOP which states that flight time will not exceed 10 hours in a 24-hour period or 15 hours in a 48-hour period."

Indorsement: "Nonconcur with the findings of the board. The established cause factor should read supervision. The flight leader displayed gross negligence by permitting his own aircraft to be operated in a reckless manner, and failed to exercise and enforce sound air discipline over the aircraft under his command by allowing the entire flight to make the high speed approach in tight formation. . . ."

Approval authority: "The findings of the accident investigation board, as amended by the indorsement, are approved."

Equipped with aircraft mishap data,
USABAAR will soon be in
position to provide factual guidance
to correct hazards which
have plagued past and current aircraft . . .
ELIMINATING SAFETY HAZARDS

Lieutenant Colonel James T. Darrah Jr.
Technical Research and Applications Department
USABAAR

IN FUTURE ARMY AIRCRAFT

MANY HAZARDS present in current Army aircraft can be designed out of future aircraft. Yet, it is one of the ironies of aviation development that to a disturbing degree, such is often not the case. For instance, in recognition of the fact that loss of hydraulics for flight controls can be catastrophic, one fairly recent design provided for two hydraulic systems and included two pumps—both driven by a single shaft of inadequate strength. Another design also included two hydraulic systems, but located all the hardware and plumbing so close together that chances of double failure were greatly increased.

Equipped with a modern management information system which provides rapid storage and retrieval of aircraft mishap data, USABAAR will soon be in position to provide factual guidance, substantiated by mishap data, to correct hazards which have plagued past and current aircraft. Basically, this guidance will be in the form of penalties which hazards extort from the mission effectiveness of aircraft. The application of the system safety concept to new developmental Army aircraft programs is the means by which these penalties are derived.

USABAAR personnel have been concerned with the application of system safety to developmental aircraft for some time. A few years ago, we came face to face with the problem of using aircraft mishap data to justify system safety for new aircraft. For instance, an attempt was made to prove, through accident statistics, that the Utility Tactical Transport Aircraft System (UTTAS) should have two engines. Since no twin-engine utility helicopters were in the inventory, accident data from the twin-engine CH-47 was compared with single-engine UH-1 data. As it turned out, one model of the UH-1 actually had a better accident rate than the CH-47, a fact that did the proposal for two engines no good. Other comparisons, using CH-47 data, showed some advantages for two engines, but not in the positive manner needed. The justification seemingly was not valid because of an attempt to compare

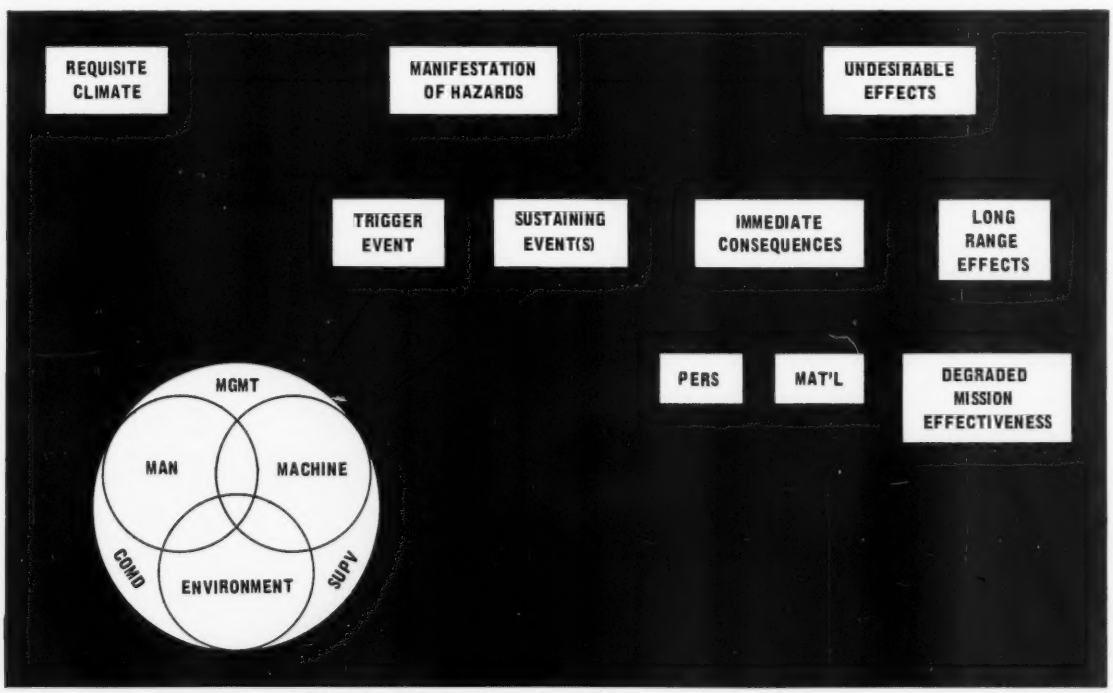
Adapted from a paper entitled "The Practical Application of Mishap Data in Army Aircraft System Safety Programs," written by LTC James T. Darrah, Jr., who presented it at the Second Government Industry System Safety Conference, 26 May 1971. The conference, sponsored by the National Aeronautics and Space Administration (NASA), was held to share experience gained in system safety and show its applicability to large and small programs. LTC Darrah is chief of the Systems Research and Technology Division of USABAAR.

apples and oranges to justify peaches. This experience showed that, unless some way to measure actual benefits to be gained from safety features in terms of mission effectiveness was found, there was little chance of justifying many of these features.

The main thrust of USABAAR's use of historical mishap data for future aircraft programs, then, is to estimate the long-range impact on mission effectiveness through proper analyses of this data. Unless the ultimate effects of mishaps on people and materiel are fully considered, the objectives of system safety cannot be attained.

With its improved management information system, USABAAR is expected to develop new methods for data analyses and use which will make substantial and influential contributions to the advancement of system safety. Since it serves as the central agency for the Army aviation accident prevention program, which includes the receipt, processing and analysis of all data and information related to Army aircraft mishap experience, USABAAR is in a position to realize the maximum return from historical aircraft mishap data. The past teaches us what to expect from the future and this vast store of historical data contains a wealth of knowledge for designers and users of future Army aircraft.

System safety furnishes management a tool to conserve resources through the prevention of mishaps by designing safety into aircraft systems. The heart of this process is hazard analysis in which each system is examined in a methodical and comprehensive way at each stage of its development to isolate hazards. At some point during development, decisions must be made concerning what is to be done to correct hazards identified through analysis. Sometimes it costs nothing to correct or eliminate a hazard. Sometimes the hazard is so great that it must be eliminated regardless of the penalty involved. But the vast majority of hazards falls somewhere in between these ex-



tremes. It then evolves into decisions based on needs to eliminate hazards and the penalties in terms of weight and cost required. Decision-makers must weigh the price to be paid against benefits to be gained. In the past, they could only fall back on the category assigned the hazard on the basis of MIL STD 882, the system safety standard. They have not been able to relate hazards to adverse long-range consequences.

History has shown that new operational aircraft systems rarely incorporate a very large number of advanced technological features. Instead, new aircraft represent rational growth versions of previous aircraft, with improvements made where practical and high technical risk features held to a minimum, consistent with performance requirements. As a general rule, there is not much really new in new systems and, accordingly, there are few new hazards. The features of a developmental aircraft which are not actually new provide the points where historical mishap data which reveal hazards in previous systems are most directly applicable.

Historical mishap data is exactly what its name implies—the details of the history of mishaps. These details can be placed in general categories of the basic elements and effects shown by the accompanying diagram. The elements and effects, which comprise much of the input data for the improved management information system, are:

The first element of an accident is the requisite climate—the set of hazardous conditions which must be present before an accident can occur. This requisite climate includes the familiar threesome of man, machine and environment, plus overall factors of command, management and supervision.

The condition of the people involved is perhaps the most complex factor present. Their physical condition, state of mind, morale, proficiency and a wide variety of physiological and psychological factors all interrelate in a complex way to affect the potential human involvement in an accident.

The condition of machines also involves a highly complex, functional relationship of hardware which must exist in just the right way before an accident can occur. This relationship includes maintenance practices, worn pieces or parts, age of the equipment, design deficiencies, operating limitations, etc., which increase in complexity with newer, more sophisticated aircraft.

System safety furnishes management a tool to conserve resources through the prevention of mishaps by designing safety into aircraft systems. The heart of this process is hazard analysis

The command or management influence existing in an operation may play a significant role. For example, some casual remark by the commander at a morning briefing quite innocently may start a chain of events leading to catastrophe. Such influence most likely will concern the urgency of a mission to be performed, the quality of results desired or the belittling of problems, obstacles and risks. The impression conveyed may be, "Accomplish the mission, whatever the cost," an implication tantamount to a command endorsement of recklessness.

Environmental conditions cover an extremely broad range of phenomena including weather, terrain, operational situations, air traffic control, airfield facilities and many more. The true influence of these conditions on accidents is most often not known or ignored.

The worst possible combination of all these conditions could conceivably exist and no accident would result, unless some hazard manifested itself. Given the requisite climate, or necessary set of conditions, the manifestation of the proper hazard initiates the accident sequence. As shown in the accident schematic, this sequence can usually be divided into two or more main occurences: precipitating (trigger) and sustaining events.

The sequence starts with some trigger event that can be produced by a staggering variety of causes involving man, machine, environment and management, or any combination of the four. Until this time, the factors present in the requisite climate have played a passive role, and the cause-effect relationship is generally not very precise.

ELIMINATING HAZARDS

With the occurrence of the trigger event, however, the sequence usually becomes quite predictable. What was potentially a hazardous condition before will now manifest itself through some event that, in itself, may not be considered hazardous. For example, shutting down one engine in a twin-engine aircraft at altitude may present no hazard whatsoever. Shutting down that same engine while on short final approach during an emergency landing because the *other* one failed earlier could—and did—have disastrous consequences.

Rarely does an accident occur as a result of one single event. Usually, a series of several events follows the trigger event in sequence up to the accident itself. These can be called "sustaining events."

Thus, when the requisite climate, or potentially hazardous conditions, exists, the accident sequence begins with a trigger event, is carried forward through sustaining events, and an accident occurs. These factors and events are all grist for the historical accident mill.

At the risk of belaboring the obvious, let's recall that the undesirable effects of accidents are the real justification for any attempt at accident prevention. These effects can be grouped into two general areas with respect to time—immediate and long-range. Patently, the possible injury and death of personnel, plus the abrupt damage and destruction to material, are the immediate consequences of an accident. Not quite so evident are the long-range effects that have an impact far beyond the time and geographical location of the accident itself. To the Army, these effects add up to a total cost in terms of lost or degraded mission capability. Each aircraft accident, no matter how insignificant in terms of immediate consequences, has some adverse effect on the capability of the Army to accomplish its mission. If the total number of aircraft accidents is substantial, then the impact on mission effectiveness also will be substantial.

The accomplishment of the Army's mission requires that certain aviation resources—people and materiel—be available at any time. Any lack of these resources logically has a direct bearing on mission effectiveness and accomplishment.

History has shown that new operational aircraft systems rarely incorporate a very large number of advanced technological features. Instead, new aircraft represent rational growth versions of previous aircraft. . . .

Since these resources cannot be acquired instantaneously, the Army must not only project its future mission, it must also project the total aviation resources required to perform that mission. Such estimates and projections are made for periods of time as far into the future as practicable and then are refined as time passes. This extremely complex process includes the important projection of the status of the current aircraft inventory, as well as the status of aviation personnel and facilities. Any shortfall of quantity, quality or capability in projected inventories, personnel or facilities, compared with estimated requirements, gives the basis for planning to acquire these resources. If losses in aircraft and personnel are underestimated, for instance, or quality in new aircraft is not adequately provided for, an adverse impact on mission effectiveness results.

The most fertile areas for application of the USABAAR management information system appear to be in the estimation of aircraft and personnel losses and in the provision of quality in new aircraft. It is in these areas that the traditional safety parameters such as the periodic accident rate, total fatalities, categorized cause factors, total injuries and total costs are no longer sufficient for the solution of many accident prevention problems. These general parameters indicate broad fields of interest which should be analyzed and evaluated in detail. It bears repeat-

ing that the detailed effects on mission capability must be identified to justify corrections and the costs of such actions.

The management information system with its digital computer, capable of storing and retrieving specific circumstances surrounding individual mishaps, [see "ABACUS," by Emil Spezia, October 1970 AVIATION DIGEST] has already significantly improved our ability to clearly and comprehensively define the requisite climate, sequence of events and the mechanism by which hazards manifest themselves. In addition, areas for corrective action can be pinpointed more accurately, together with the specific action required and the priorities for that action. Measures to limit the requisite climate and to inhibit hazard manifestation in the accident situation can be forecast. At the same time, such measures can be placed in context with their influence on the long-range undesirable effects of accidents.

To assist in determining these long-range effects and, eventually, afford decisionmakers some of the information they need to weigh the benefits gained against costs, methods have been developed to apply this expanded capability to developmental aircraft systems. These methods have shown that the gap can be successfully bridged between historical mishap data on a fleet of existing aircraft and potential hazards in future aircraft which now exist only in concept. While there is still much to be done, progress in analytical work has been made in two significant areas.

Future aircraft should be designed for the specific environment in which they are intended to operate. Although this consideration is not new, a major effort is now underway to clearly define, in detail, the environment in which various types of Army aircraft are expected to operate in the future. Given this definition, USABAAR should be in a position to identify the specific environmental conditions which favor accidents and to specify detailed design criteria to counter these conditions.

The matrix-generating capability of the computer has made it possible to compare the more detailed elements of information now acquired through mishap investigations. From the large number of possible combinations, relationships have been established among the most significant data elements, thus providing indexes for various areas of interest, such as fires in aircraft. A "Fire-worthiness Index" has been developed that measures all detailed factors relating to the incidence of aircraft fires and their immediate and long-range effects. This index has been established for each type, model and series of aircraft in the Army inventory, so that rankings among aircraft can be obtained. All the known elements shown in the accident schematic are included. On the basis of detailed insight into past fire experiences, specific operations and aircraft configurations are evaluated to determine those conditions which affect the index. The specification of fire-worthiness criteria for future aircraft, then, follows this evaluation directly. Furthermore, these criteria can be assigned relative priorities on the basis of this index.

The index approach is also being used for the establishment of design criteria in terms of alternatives that are expressed as functions of the long term impact on mission effectiveness. Though somewhat general in nature at present, more specific criteria will be developed as analytical studies are completed. In addition to the estimate of long-range impact, recommendations for developmental specifications will include alternatives expressed as functions of program costs, schedules and system performance. Such estimates should be of maximum benefit to the designer-developer. In use, they will help to assure maximum effectiveness of system safety efforts.

In very general terms, we have discussed USABAAR's intended use of the management information system for solving the difficult problem of applying historical mishap data to new developmental aircraft programs. The surface has only been scratched, but in-depth studies and analyses should lead eventually to more effective attainment of system safety objectives in the design and development of future Army aircraft. Through these means, it is hoped USABAAR can soon substantially contribute to eliminating hazards found in current Army aircraft and from those still in design and developmental stages.

IT PAYS TO BE SURE

TH-55A IP: "We made our runup checks and the fuel gauge read 30 gallons as we departed en route to a stagefield. We checked in with air traffic, made one approach, then departed traffic and made four simulated forced landings in about 15 minutes. We reentered traffic, shot another approach, worked on the student's hovering technique and then made a normal takeoff. At approximately 250 to 300 feet, with 35 knots air speed, we experienced a grinding noise at 1-second intervals with no vibrations. I took control as the helicopter turned left approximately 90 degrees, and the rotor and engine rpm started to decay with the needles joined. I attempted to roll on throttle and put the pitch down. At this point, we were approximately 100 feet above the ground, so I maneuvered toward a hole in the trees and flared at about 20 feet. At about 10 feet, we passed over a tree to a small open area. I pulled pitch, with no apparent effect. We contacted the ground in level attitude and bounced, turning 180 degrees to the right and coming to rest upright. . . . "

Investigation: "An interview with the student pilot revealed that he found the logbook positioned between the two seats. This normally indicates aircraft has been serviced with fuel and oil. He did not recall removing the fuel tank cap and checking the fuel level during his preflight. He estimated 4 to 6 minutes of engine operation between engine start and takeoff. He believed the fuel gauge indicated full prior to takeoff and he stated the fuel gauge indicated 20 gallons during their last landing approach. After hovering for approximately 7 minutes, he told the IP the fuel gauge was indicating zero. He said the IP advised him that fuel gauges often became inoperative and they would continue the flight.

"The IP stated that on his arrival at the helicopter he checked the DA Form 2408-13 for status *only*, while the SP started preflighting. He said he was unable to supervise the entire preflight because he was preoccupied with locating maintenance assistance. He did not personally check the fuel tank and did not see the student pilot check it. He said that he saw fuel on the ground under each fuel sump.

"The board considered the helicopter's position, altitude and heading at the time of engine stoppage, the 90-degree left yaw, the light southeast wind and data obtained by flying the route from the takeoff point. It was determined that better landing sites were available if the IP had selected an area without delay when the engine stopped.

"The DA Form 2408-13 indicated the helicopter had not been serviced with fuel or oil following the previous flight that day. The -12 and -13 forms showed it had been serviced with 17 gallons of fuel after the second flight prior to the accident. This flight was for 1 hour and 15 minutes. Total engine time for the accident flight was 51 minutes. It was determined there was no failure of any system or component."

Findings: "The IP failed to properly monitor the SP's preflight and failed to follow the preflight checklist which calls for checking the fuel tank for fuel quantity. He failed to land and verify the fuel status when the fuel gauge indicated zero. Through these failures, the IP caused inflight engine stoppage due to fuel exhaustion, and exhibited poor judgment and technique in performing the autorotation."

TH-55 tail boom lies in front of sagging blades and fuselage after hard landing during fuel exhaustion autorotation

Three to Make Ready

A UH-1H PILOT, copilot and crew chief who had been sleeping in the helicopter were awakened at night and released to return to their home base. Within 3 minutes, they started and took off with the landing light on. Approximately 1 minute after takeoff, the UH-1H was seen to make a steep right 180-degree turn back toward the pad. Following this, it made quick short turns to right and left, and crashed in a 60- to 70-degree dive angle. A loud explosion was heard and the helicopter burned. The three crew members were killed at impact.

Analysis: ". . . Compression of the pilots' seats indicated an impact in excess of 50 g. Teardown and evaluation of available components revealed no failures other than those caused by impact.

"Several aviators flying in the vicinity of the crash site stated weather was below night rotary wing VFR minimums. They said it had deteriorated rapidly. There was no attempt by the crew to obtain current weather before takeoff, though they had been alerted to the possibility of bad weather and could have obtained current pilot reports of the weather prior to takeoff by using a ground radio positioned at the site.

"The crews of two helicopters who attempted to reach the crash site a few minutes after the accident, as well as the crew of the medevac helicopter, reported that weather—low ceiling and poor visibility—prevented them from reaching the site.

"The UH-1H pilots could not have been aware of the existing weather and were not prepared to encounter extremely low ceilings. Indications

Three minutes from wakeup to takeoff into unknown weather conditions at night resulted in spatial disorientation, the loss of three lives and this UH-1H

were that they inadvertently flew into the weather almost immediately after takeoff and were attempting to return.

"It was considered highly probable that one or both pilots experienced spatial disorientation while attempting to maintain visual flight. This was further aggravated by the use of the landing light during the entire flight. Continued use of the landing light in the existing weather conditions created a situation in which the pilots must have had extreme difficulty in maintaining visual contact with ground references.

"The fact that a number of quick turns were made could well have accentuated or induced disorientation. The crew had just awakened and vertigo could have been easily induced. Additionally, considering the rapid start and takeoff, it's probable that their flight instrument gyros had not had sufficient time to stabilize and operate correctly. . . ."

Flight surgeon: ". . . The force of impact killed all persons aboard instantly and no amount of survival equipment could have helped them. Judging from the factors involved, it is probable the pilots did not have sufficient time to become alert enough to properly deal with their situation. Vertigo could be easily induced in this situation. It is also probable the pilot was not confident enough of his instrument flying capability to go on instruments and fly out of the weather.

"Severe deceleration forces in this accident resulted from the steep angle of impact and extremely short stopping distance. The front seats were ripped from their mooring and folded almost double. The crew members wore K2B flight suits which afforded negligible resistance to fire. All wore APH-5 helmets. The copilot's helmet was shattered and burned with only parts recognizable. The helmets of the other two crew members were found outside the wreckage in fair condition. The helmet worn by the crew chief had three layers of sizing pads. In this instance, it made no difference. In another, this could well be a grave matter."

Findings: Although the board could not positively prove any single factor the cause of this accident, it did agree that, of the many factors involved, spatial disorientation was the most prevalent. Crew errors that led to spatial disorientation were considered to be:

Failure to obtain current weather prior to takeoff.

Failure to allow time for instrument gyros to become fully operational.

Continued use of the landing light throughout the flight.

Failure to allow themselves time to become fully alert.

Attempting to maintain VFR flight in IMC.

Reviewing official: "Concur with the findings of the board. However, supervisory failure also contributed to this accident. If explicit instructions, including precautionary measures concerning the weather, had been relayed to the crew members, they would have been better prepared to cope with the situation. . . ."

Comment: Any flight, even a 15-minute hop in bright sunlight, demands more preparation and planning than the 180 seconds used by this crew from wakeup to airborne. The more thorough and complete planning and preparations are, the easier and more successful all flights are apt to be. Remember this the next time you are tempted to kick the tire and light the fire.

WATERLOGGED

UH-1 IP: ". . . We had a call from a stagefield, requesting someone to take a look at several helicopters which were in the path of rising water. About 15 minutes later, I arrived at the field and saw that four UH-1s needed to be moved. As the only rated aviator on the field at that time I immediately started to move them. Coming back for the fourth helicopter, I saw three more on which water was rising at an unbelieveable speed. We had to get to them first. In the process, we drove the 3/4-ton truck into a washout and water filled the cab as we crawled out. By the time we got out of the water and to a jeep, it was impossible to get the helicopters out with any margin of safety.

"Water was covering our jeep's radiator in some places. Since some of the helicopters were broadside to a swift current, I decided to try and get the others out. . . . The water was constantly rising. Actually, it's

Rapidly rising water entered fuselage of this helicopter and caused an out-of-c.g. condition when the pilot attempted to pick it up too quickly, without allowing time for the water to drain

still hard to believe the rate at which the field was covered. It seemed as if a dam had broken.

"I selected the helicopter which seemed to be covered with the most water and had a truck placed on the pad to my front to help give me a visual reference because of the water on the windshield and the swift current. After runup, I picked up slowly to allow the water to drain. I pulled the cyclic against the aft stop, but the current prevented any movement. I was about 1 foot off the pad and this allowed the water to drain and improve the cyclic control range. After gaining aft cyclic control, I picked up further until the UH-1 completely cleared the water. Using the truck for visual reference and with guidance aid from personnel on the ground, I maintained a stationary hover for at least 1 minute. This allowed the water to drain from the chin bubble and I then had the full range of cyclic control. I hovered clear of the water and parked. . . .

"At this point, two other pilots were on the scene to help move the remaining helicopters. Water was covering the cross tubes of one, approximately 3 to 4 inches below the pilot's door. After cranking, the pilot brought it up to operational rpm. He applied collective and the helicopter appeared to tilt around the chin bubble. It then appeared that the pilot lowered collective, because the UH-1 leveled out. He applied collective again and started flying extremely nose low. He gained approximately 50 feet of altitude, then crashed nose low in a slight right bank. The pilot had minor cuts from plexiglass. He was wearing a short-sleeve shirt, short pants, no shoes and no helmet. . . .

"It appeared to me the pilot's decision to fly was entirely too hasty. He allowed no time for the water to drain and was unable to maintain control because the water put the helicopter out of c.g. . . ."

Analysis: "The pilot had received a request for assistance and was under the impression that no other flight personnel were available to move the helicopters from the water. On his arrival, he was not given definite instructions about what to do. He selected a helicopter which appeared to be in the shallower water and saw that he would have to wade out to it, so he removed his boots and flight clothing. Subsequently, he was driven to it in a truck and entered directly through the left cargo door. He did not check the logbook and immediately started and ran up. He attempted to raise the helicopter out of the water too quickly, and as the water in the fuselage displaced forward, it rapidly changed the center of gravity. He ran out of aft cyclic control as he became airborne and the nose dipped rapidly due to the internal water shifting forward. After the helicopter cleared the water, it accelerated toward some trees in a nose low attitude. The pilot immediately reduced collective to keep from hitting the trees and the UH-1 struck the water in an extreme nose low attitude, causing major damage to the main rotor system, forward cabin section, tail boom and tail rotor. . . ."

Findings: "This accident was due to crew performance, in that the pilot used poor judgment and employed improper control technique in his attempt to fly a helicopter which was submerged up to floor level.

"There was no directive establishing responsibility for helicopters located at the stagefield after flying was completed or cancelled.

"There was no contingency plan in effect for emergency evacuation of helicopters.

"The stagefield SOP did not designate a responsible individual to take charge of coordinating the control and movement of aircraft from the stagefield in the event of impending disasters or emergencies.

"No briefing was conducted for the personnel assigned to coordinate the control and movement of aircraft for evacuation.

"There was no ground handling equipment available to help move aircraft to safe locations."

Approving authority: "Supervisory error is established as a cause factor in that the pilot was instructed to move a helicopter in a potentially dangerous flying condition without benefit of a briefing concerning the hazards."

USAASO Sez

The U. S. Army Aeronautical Services Office discusses

Revised AR 95-37

Controller of the year award

FLIP binding

AR 95-37: The first major revision of AR 95-37 has been completed and gone to press. You should see it in the field soon. The first thing you should notice is the change in title. The new reg is entitled, "Army Air Traffic Control—General Provisions." This will permit the inclusion of any subject matter relating to air traffic control. The chapter entitled "General Operating Rules" is gone. As you know, all that info is now in the new TM 95-200. A new chapter has been added which spells out the Army air traffic controller of the year award. More on that below.

Army Air Traffic Controller of the Year: Well now, how about that? After all these years the Army controller is to be recognized as part of the big team! The Army is starting its controller of the year program with three objectives: First, to give recognition to the one controller who stands out above all the rest. Secondly, to upgrade the Army's ATC program. Thirdly, to provide some competition to the FAA and the other military services for the annual Air Traffic Control Association (ATCA) controller of the year award.

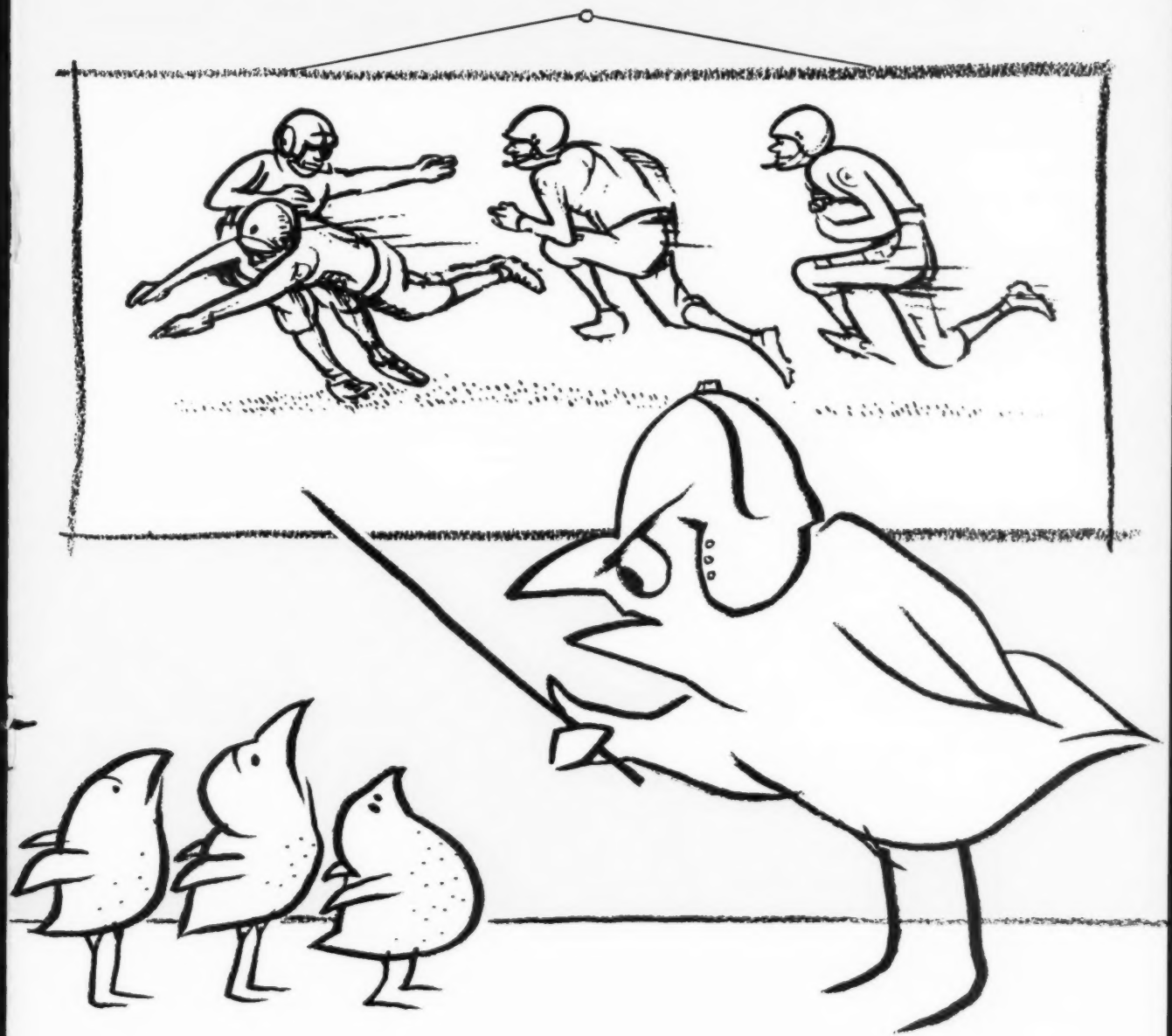
This program has been approved and is being incorporated into the new AR 95-37. All the necessary instructions are contained in the AR. The winner of the award will be presented with a trophy, hopefully at the graduation ceremonies of the Army's Air Traffic Control School. (The details of the presentation have not been worked out as yet.) In addition, the Army air traffic controller of the year will be the Army's nominee to the ATCA and will represent the Army at the annual ATCA conference at which the controller is named who has been selected as *the* air traffic controller of the year.

Who will be the first official Army air traffic controller of the year?

Special Binding: Did you know that DOD FLIP approach chart booklets have a special binding? Judging from the number of comments USAASO receives from users, this is a little known fact.

The binding on the FLIP approach chart booklets is the result of extensive research conducted by civil and military flight publication agencies. This special binding is designed to permit the opened booklet to be bent backwards double without breaking. The booklet will then lie flat and pages will not be lost.

Loose-leaf binders are often recommended; however, the probable loss of pages, the considerable time required to post loose-leaf revisions and the cost dictate against this system. Surely you older (and not so bold) types remember the hours spent posting the JEP manuals!



"Planning, Preparation, Teamwork!
That's what it takes to make winning plays!"

XU